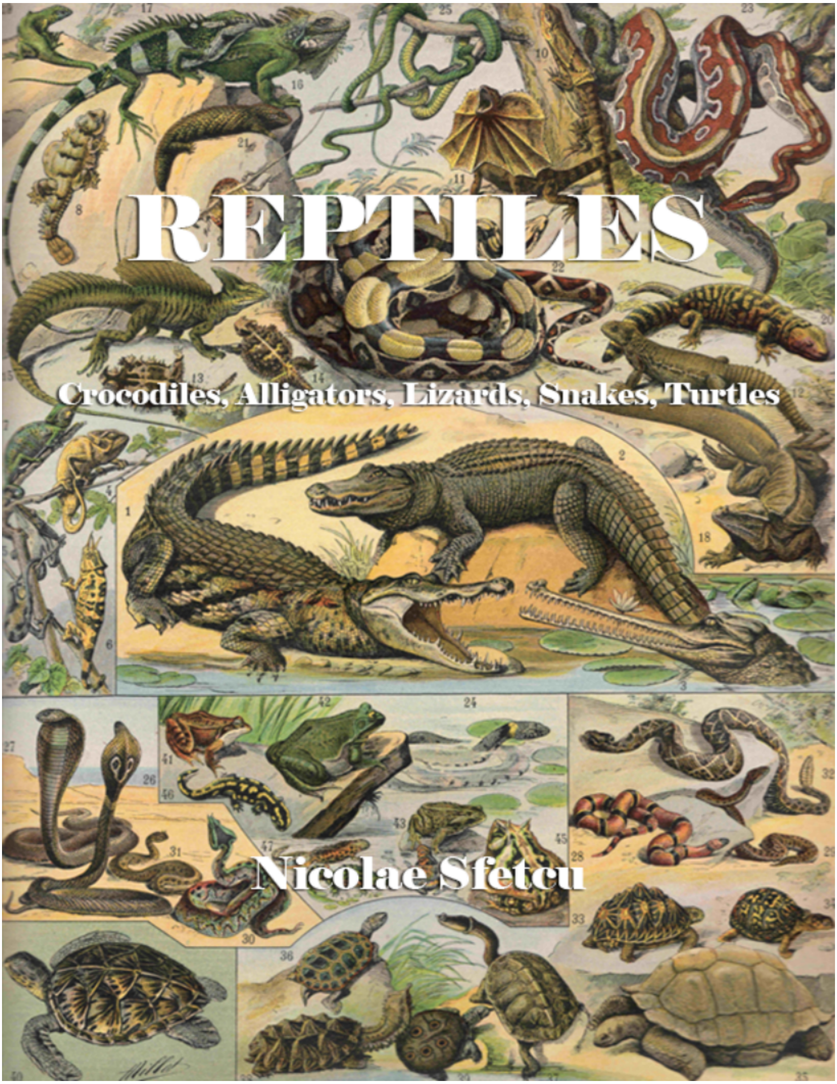
REPTILES
Crocodiles, Alligators, Lizards, Snakes, Turtles
Nicolae Sfetcu

Reptiles - Crocodiles, Alligators, Lizards, Snakes, Turtles

Nicolae Sfetcu

Published by Nicolae Sfetcu

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Reptiles - crocodiles, alligators, lizards, snakes, turtles

Fossil range: Carboniferous - Recent

Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Class: **Sauropsida,** Goodrich, 1916

Orders

- Procolophonia (extinct)
- Testudines
- Araeoscelidia (extinct)
- Avicephala (extinct)
- Younginiformes (extinct)
- **Sauropterygia**
  - Ichthyosauria (extinct)
  - Placodontia (extinct)
  - Nothosauria (extinct)
  - Plesiosauria (extinct)
- Sphenodontia
- Squamata
- Prolacertiformes (extinct)
- **Archosauria**
  - **Crurotarsi**
    - Order Aetosauria
    - Order Phytosauria
    - Order Rauisuchia
    - Order Crocodilia
  - **Ornithodira**
    - Pterosauria (extinct)
    - *Marasuchus* (extinct)
    - Dinosauria (extinct)
      - Order Saurischia
      - Order Ornithischia

Reptiles are tetrapods and amniotes, animals whose embryos are surrounded by an amniotic membrane. Today they are represented by four surviving **orders**:

- **Crocodilia** (crocodiles, caimans and alligators): 23 species

- **Sphenodontia** (tuataras from New Zealand): 2 species
- **Squamata** (lizards, snakes and amphisbaenids ("worm-lizards")): approximately 7,600 species
- **Testudines** (turtles): approximately 300 species

Reptiles are found on every continent except for Antarctica, although their main distribution comprises the tropics and subtropics. Though all cellular metabolism produces some heat, most modern species of reptiles do not generate enough to maintain a constant body temperature and are thus referred to as "cold-blooded" or ectothermic (the Leatherback Sea Turtle is an exception). Instead, they rely on gathering and losing heat from the environment to regulate their internal temperature, e.g, by moving between sun and shade, or by preferential circulation — moving warmed blood into the body core, while pushing cool blood to the periphery. In their natural habitats, most species are adept at this, and can ususally maintain core body temperatures within a fairly narrow range, comparable to that of mammals and birds, the two surviving groups of "warm-blooded" animals. While this lack of adequate internal heating imposes costs relative to temperature regulation through behavior, it also provides a large benefit by allowing reptiles to survive on much less food than comparably-sized mammals and birds, who burn much of their food for warmth. While warm-blooded animals move faster in general, an attacking lizard, snake or crocodile moves very quickly.

Except for a few members of the Testudines, all reptiles are covered by scales.

Most reptile species are oviparous (egg-laying). Many species of squamates, however, are capable of giving live birth. This is achieved, either through ovoviviparity (egg retention), or viviparity (babies born without use of calcified eggs). Many of the viviparous species feed their fetuses through various forms of placenta analogous to those of mammals (Pianka & Vitt, 2003 pgs: 116-118). They often provide considerable initial care for their hatchlings.

Reptiles

Contents

Classification of reptiles

Reptiles are a paraphyletic group. The group can be made monophyletic by including the birds (Aves).

From the classical standpoint, reptiles included all the amniotes except birds and mammals. Thus reptiles were defined as the set of animals that includes crocodiles, alligators, tuatara, lizards, snakes, amphisbaenians and turtles, grouped together as the class **Reptilia** (Latin *repere*, "to creep"). This is still the usual definition of the term.

However, in recent years, many taxonomists have begun to insist that taxa should be monophyletic, that is, groups should include all descendants of a particular form. The reptiles as defined above would be paraphyletic, since they exclude both birds and mammals, although these also developed from the original reptile. Colin Tudge writes:

> *Mammals are a clade, and therefore the cladists are happy to acknowledge the traditional taxon Mammalia; and birds, too, are a clade, universally ascribed to the formal taxon Aves. Mammalia and Aves are, in fact, subclades within the grand clade of the Amniota. But the traditional class reptilia is not a clade. It is just a section of the clade Amniota: the section that is left after the Mammalia and Aves have been hived off. It cannot be defined by synamorphies, as is the proper way. It is instead defined by a combination of the features it has and the features it lacks: reptiles are the amniotes that lack fur or feathers. At best, the cladists suggest, we could say that the traditional Reptila are 'non-avian, non-mammalian amniotes'.* (Tudge, p.85)

> *By the same token, the traditional class Amphibia becomes Amphibia*, because some ancient amphibian or other gave rise to all the amniotes; and the phylum Crustacea becomes Crustacea*, because it may have given rise to the insects and myriapods (centipedes and millipedes). If we believe, as some (but not all) zoologists do, that myriapods gave rise to insects, then they should be called Myriapoda*....by this convention Reptilia without an asterisk is synonymous with Amniota, and includes birds and mammals, whereas Reptilia* means non-avian, non-mammalian amniotes.* (Tudge, p.85)

Recent college-level references, such as Benton (2004) [1], offer another compromise by applying traditional ranks to accepted phylogenetic relationships. In this case, reptiles belong to the class

Sauropsida, and mammal-like reptiles to the class Synapsida, with birds and mammals separated into their own traditional classes.

Reptile Groups

- **Class Sauropsida**
    - Family Captorhinidae (extinct)
    - Family Protorothyrididae - Hylonomus (extinct)
    - **Subclass Anapsida**
        - Family Mesosauridae (extinct)
          Order Procolophonia - incl. Pareiasaurs (extinct)
          ?Order Testudines - Turtles
    - **Subclass Diapsida**
        - Superorder Ichthyopterygia - Ichthyosaurs (extinct)
        - **Infraclass Lepidosauromorpha**
            - Superorder Sauropterygia - Plesiosaurs (extinct)
            - Superorder Lepidosauria
                - Order Sphenodontia - Tuatara
                - Order Squamata - Lizards & Snakes
        - **Infraclass Archosauromorpha**
            - Order Crocodilia - Crocodilians
            - Order Pterosauria - Pterodactyls (extinct)
            - Superorder Dinosauria - Dinosaurs
                - **Class Aves** - Birds

Evolution of the reptiles

Hylonomus is the oldest-known reptile, and was about 8 to 12 inches (20 to 30 cm) long. Westlothiana has been suggested as the oldest reptile, but is for the moment considered to be more related to amphibians than amniotes. Petrolacosaurus and Mesosaurus are other examples. The first true "reptiles" (Sauropsids) are categorized as Anapsids, having a solid skull with holes only for nose, eyes, spinal cord, etc. Turtles are believed by some to be surviving Anapsids, as they also share this skull structure; but this point has become contentious lately, with some arguing that turtles reverted to this primitive state in order to improve their armor. Both sides have strong evidence, and the conflict has yet to be resolved.

Shortly after the first reptiles, two branches split off, one leading to the Anapsids, which did not develop holes in their skulls. The other group, Diapsida, possessed a pair of holes in their skulls behind the eyes, along with a second pair located higher on the skull. The Diapsida split yet again into two lineages, the lepidosaurs (which contain modern snakes, lizards and tuataras, as well as, debatably, the extinct sea reptiles of the Mesozoic) and the archosaurs (today represented by only crocodilians and birds, but also containing pterosaurs and dinosaurs).

The earliest, solid-skulled amniotes also gave rise to a separate line, the Synapsida. Synapsids developed a pair of holes in their skulls behind the eyes (similar to the diapsids), which were used to both lighten the skull and increase the space for jaw muscles. The synapsids eventually evolved into mammals, and are often referred to as mammal-like reptiles, though they are not true members of the class Sauropsida.

Systems

Circulatory

Most reptiles have closed circulation via a three-chamber heart consisting of two atria and one, variably-partitioned ventricle. There is usually one pair of aortic arches. In spite of this, due to the fluid dynamics of blood flow through the heart, there is little mixing of oxygenated and deoxygenated blood in the three-chamber heart. Furthermore, the blood flow can be altered to shunt either deoxygenated blood to the body or oxygenated blood to the lungs, which gives the animal greater control over its blood flow, allowing more effective thermoregulation and longer diving times for aquatic species. There are some interesting exceptions among reptiles. For instance, crocodilians have an incredibly complicated four-chamber heart that is capable of becoming a functionally three-chamber heart during dives (Mazzotti, 1989 pg 47). Also, it has been discovered that some snake and lizard species (e.g., monitor lizards and pythons) have three-chamber hearts that become functional four-chamber hearts during contraction. This is made possible by a muscular ridge that subdivides the ventricle during ventricular diastole and completely divides it during ventricular systole. Because of this ridge, some of these squamates are capable of producing ventricular pressure differentials that are equivalent to those seen in mammalian and avian hearts (Wang et al, 2003).

Respiratory

All reptiles breathe using lungs. Aquatic turtles have developed more permeable skin, and even gills in their anal region, for some species (Orenstein, 2001). Even with these adaptations, breathing is never fully accomplished without lungs. Lung ventilation is accomplished differently in each main reptile group. In squamates the lungs are ventilated almost exclusively by the axial musculature. This is also the same musculature that is used during locomotion. Because of this constraint, most squamates are forced to hold their breath during intense runs. Some, however, have found a way around it. Varanids, and a few other lizard species, employ buccal pumping as a complement to their normal "axial breathing." This allows the animals

to completely fill their lungs during intense locomotion, and thus remain aerobically active for a long time. Tegu lizards are known to possess a proto-diaphragm, which separates the pulmonary cavity from the visceral cavity. While not actually capable of movement, it does allow for greater lung inflation, by taking the weight of the viscera off the lungs (Klein et al, 2003). Crocodilians actually have a muscular diaphragm that is analogous to the mammalian diaphragm. The difference is that the muscles for the crocodilian diaphragm pull the pubis (part of the pelvis, which is movable in crocodilians) back, which brings the liver down, thus freeing space for the lungs to expand. This type of diaphragmatic setup has been referred to as the "hepatic piston."

How Turtles & Tortoises breathe has been the subject of much study. To date, only a few species have been studied thoroughly enough to get an idea of how turtles do it. The results indicate that turtles & tortoises have found a variety of solutions to this problem. The problem is that most turtle shells are rigid and do not allow for the type of expansion and contraction that other amniotes use to ventilate their lungs. Some turtles such as the Indian flapshell (*Lissemys punctata*) have a sheet of muscle that envelopes the lungs. When it contracts, the turtle can exhale. When at rest, the turtle can retract the limbs into the body cavity and force air out of the lungs. When the turtle protracts its limbs, the pressure inside the lungs is reduced, and the turtle can suck air in. Turtle lungs are attached to the inside of the top of the shell (carapace), with the bottom of the lungs attached (via connective tissue) to the rest of the viscera. By using a series of special muscles (roughly equivalent to a[diaphragm]), turtles are capable of pushing their viscera up and down, resulting in effective respiration, since many of these muscles have attachment points in conjunction with their forelimbs (indeed, many of the muscles expand into the limb pockets during contraction). Breathing during locomotion has been studied in three species, and they show different patterns. Adult female green sea turtles do not breathe as they crutch along their nesting beaches. They hold their breath during terrestrial locomotion and breathe in bouts as they rest. North American box turtles breathe continuously during locomotion, and the ventilation cycle is not coordinated with the limb movements (Landberg et al., 2003). They are probably using their abdominal muscles to breathe during locomotion. The last species to have been studied is red-eared sliders, which also breathe during locomotion, but they had smaller breaths during locomotion than during small pauses between locomotor bouts, indicating that there may be mechanical interference between the limb movements and the breathing apparatus. Box turtles have also been observed to breathe while

completely sealed up inside their shells (ibid).

Most reptiles lack a secondary palate, meaning that they must hold their breath while swallowing. Crocodilians have evolved a bony secondary palate that allows them to continue breathing while remaining submerged (and protect their brains from getting kicked in by struggling prey). Skinks (family Scincidae) also have evolved a bony secondary palate, to varying degrees. Snakes took a different approach and extended their trachea instead. Their tracheal extension sticks out like a fleshy straw, and allows these animals to swallow large prey without suffering from asphyxiation.

Also, crocodiles are known to cry while eating. Many myths and folklore have grown around this astonishing fact, such as that the crocodile feels guilty for eating, but in truth, the crocodile cries to release fluid from its body, to make room for oxygen. This is also due to the fact that the crocodile's nasal cavity (nose) is exceptionally small.

Excretion

Excretion is performed mainly by two small kidneys. In diapsids uric acid is the main nitrogenous waste product; turtles, like mammals, mainly excrete urea. Unlike the kidneys of mammals and birds, reptile kidneys are unable to produce liquid urine more concentrated than their body fluid. This is because they lack a specialised structure present in the nephrons of birds and mammals, called a Loop of Henle. Because of this, many reptiles use the colon and cloaca to aid in the reabsorption of water. Some are also able to take up water stored in the bladder. Excess salts are also excreted by nasal and lingual salt-glands in some reptiles.

Nervous

Advanced nervous system compared to amphibians. They have twelve pairs of cranial nerves.

Sexual

Most reptiles reproduce sexually. All male reptiles except turtles and tortoises have a twin tube like sexual organ called the hemipenes. Turtles and tortoises have a single penis. All testudines lay eggs, none

are live bearing as some lizard and snakes are. All reproductive activity occurs with the cloaca, the single exit/entrance at the base of the tail where waste and reproduction happens.

Asexual reproduction has been identified in squamates in six families of lizards and one snake. In some species of squamates, a population of females are able to produce a unisexual diploid clone of the mother. This asexual reproduction called parthenogenesis occurs in several species of gecko, and is particularly widespread in the teiids (especially Aspidocelis) and lacertids (Lacerta). Parthenogentic species are also suspected to occur among chameleons, agamids, xantusiids, and typhlopids.

Amniotic eggs are covered with leathery or calcareous shells. An amnion, chorion and allantois are present during embryonic life. There are no larval stages of development.

See also

- List of reptiles

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List of reptiles | List of marine reptiles | Tuatara

List of reptiles

This is a **list of extant reptiles** by family, spanning three subclasses.

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Subclass Anapsida

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- Suborder Cryptodira
    - Family Chelydridae - Snapping Turtles
      Family Emydidae - Pond Turtles and Box Turtles
      Family Testudinidae - Tortoises
      Family Geoemydidae - Asian River Turtles and Allies
      Family Carettochelyidae - Pignose Turtles
      Family Trionychidae - Softshell Turtles
      Family Dermatemydidae - River Turtles
      Family Kinosternidae - Mud Turtles
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Subclass Lepidosauria

Order Rhynchocephalia - Tuataras

- Suborder Sphenodontida
    - Family Sphenodontidae

Order Squamata - Scaled reptiles

- Suborder Sauria
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    - Family Chamaeleonidae - Chameleons
    - Family Iguanidae
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        - Subfamily Crotaphytinae - Collared and Leopard Lizards
        - Subfamily Hoplocercinae - Wood lizards
        - Subfamily Iguaninae - Iguanas
        - Subfamily Leiocephalinae
        - Subfamily Leiosaurinae
        - Subfamily Liolaeminae
        - Subfamily Oplurinae - Madagascar iguanids
        - Subfamily Phrynosomatinae - Horned Lizards
        - Subfamily Polychrotinae - Anoles
        - Subfamily Tropidurinae - Neotropical Ground Lizards
    - Family Gekkonidae - Geckoes
    - Family Pygopodidae - Legless lizards
    - Family Dibamidae - Blind Lizards
    - Family Cordylidae - Spinytail Lizards
    - Family Gerrhosauridae - Plated Lizards
    - Family Gymnophthalmidae - Spectacled Lizards
    - Family Teiidae - Whiptails and Tegus
    - Family Lacertidae - Lacertids
    - Family Scincidae - Skinks
    - Family Xantusiidae - Night Lizards
    - Family Anguidae - Glass Lizards
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    - Family Tropidophiidae - Dwarf boas
    - Family Uropeltidae - Shield-tail Snakes
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    - Family Acrochordidae - File Snakes
    - Family Atractaspididae - Mole Vipers
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        - Subfamily Azemiopinae - Fea's viper
        - Subfamily Causinae - Night adders
        - Subfamily Crotalinae - Pit vipers
        - Subfamily Viperinae - Pitless vipers

Subclass Archosauria

Order Crocodylia - Crocodiles

- Suborder Eusuchia
  - Family Crocodylidae

See also

- Reptile

Cited references

1. ^ Viperidae (TSN 174294). Integrated Taxonomic Information System. Accessed on 23 August 2006.

External links

- The EMBL Reptile Database

Tuatara

Conservation status: Vulnerable

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Sphenodontia
Family: Sphenodontidae
Genus: ***Sphenodon,*** Gray, 1831
Species

- *Sphenodon punctatus* (Gray, 1842)
- *Sphenodon guntheri* Buller, 1877
- *Sphenodon diversum* (extinct)

The **tuatara** is a reptile of the family Sphenodontidae, endemic to New Zealand. The two species are the only surviving members of the Sphenodontians. The tuataras resemble lizards, but are equally related to lizards and snakes, which are their closest living relatives. For this reason, they are of great interest in the study of the evolution of lizards and snakes, and for the reconstruction of the appearance and habits of the earliest diapsids (the group that additionally includes birds and crocodiles).

The tuatara has been classified as an endangered species since 1895. Tuataras, like many of New Zealand's native animals, are threatened by habitat loss and introduced species, such as mustelids and rats. They were extinct on the mainland, with the remaining populations confined to 32 offshore islands,[1] until the first mainland release into the heavily fenced and monitored Karori Wildlife Sanctuary in 2005.

Contents

Taxonomy and evolution

Tuataras, and their sister group Squamata (which includes lizards, snakes and amphisbaenians), belong to the superorder Lepidosauria, the only surviving taxon within Lepidosauromorpha. Squamates and tuataras both show caudal autotomy, loss of the tail-tip when threatened, and have a transverse cloacal slit.[2] The origin of the tuatara probably lies close to the split between the Lepidosauromorpha and the Archosauromorpha. Though tuatara resemble lizards, the similarity is mostly superficial, since the family has several characteristics unique among reptiles. The typical lizard shape is very common for the early amniotes; the oldest known fossil of a reptile, the Hylonomus, resembles a modern lizard.

Tuataras were originally classified as lizards in 1831 when the British Museum received a skull. The species remained misclassified until 1867, when Albert Günther of the British Museum noted features similar to birds, turtles and crocodiles. He proposed the order Rhynchocephalia (meaning "beak head") for the tuatara and its fossil relatives.

During the years since the inception of the Rhynchocephalia, many disparately related species have been added to this order. This has resulted in turning the rhynchocephalia into what taxonomists call a "wastebin taxon".[3] Sphenodontia was proposed by Williston in 1925.[3] Now, most authors prefer to use the more exclusive order name of Sphenodontia for the tuatara and its closest living relatives.[4]

There are two extant species of tuatara: *Sphenodon punctatus* and the much rarer *Sphenodon guntheri*, or Brothers Island tuatara, which is confined to The Brothers Islands in Cook Strait.[5] The Brothers Island tuatara have olive skin with yellowish patches. Sphenodon punctatus has two subspecies: the Cook Strait tuatara (unnamed subspecies), which lives on other islands in and near Cook Strait, and the northern tuatara (Sphenodon punctatus punctatus), which lives on the Bay of Plenty, and some islands further north.[1]

Tuataras have been referred to as living fossils [6] This means that they have remained mostly unchanged throughout their entire history, which is approximately 200 million years.[6] However, taxonomic work[7] on Sphenodontia has shown that this group has undergone a variety of changes throughout the Mesozoic. Many of the niches normally associated with lizards were instead held by sphenodontians. There was even a successful group of aquatic sphenodontians known as pleurosaurs, which differed markedly from living tuataras. Tuataras show cold weather adaptations that allow them to thrive on the islands of New Zealand; these adaptations are probably unique to

tuataras and not present in extinct sphenodontians, which lived in much warmer climates.

Physical description

The tuatara is considered the most unspecialised living amniote; the brain and mode of locomotion resemble that of amphibians and the heart is more primitive than any other reptile. Adults are about 50 centimetres (20 in) long and weigh between 0.5 and 1 kilogram (1.1-2.2 lb). They display sexual dimorphism, as the males are larger, weighing up to 1 kilogram (2.2 lb), almost twice the weight reached by females. The spiny crest on their back, made of triangular soft folds of skin, is bigger in males than in females, and can be stiffened for display. The male abdomen is narrower than the female's. The tuatara's color ranges from olive green to brown to orange-red, and it can change color over its lifetime. It sheds its skin once a year.

Skull

In the course of evolution, the skull has been modified in most diapsids from the original version evident in the fossil record. However, in the tuatara, all the original features are preserved: it has two openings (*temporal fenestrae*) on each side of the skull, with complete arches. In addition, in the tuatara, the upper jaw is firmly attached to the skull. This makes for a very rigid, inflexible construction.
Testudines (turtle and tortoise) skulls were once believed to be the most primitive among amniotes, but newer research suggests this is not the case, as they might have lost the temporal holes in the skull secondarily rather than never having had them.[2]

The tip of the upper jaw is beaklike and separated from the remainder of the jaw by a notch. There is a single row of teeth in the lower jaw and a double row in the upper jaw, with the bottom row fitting perfectly between the two upper rows when the mouth is closed.[2] This is a tooth arrangement not seen in any other reptiles; although most snakes also have a double row of teeth in their upper jaw, their arrangement and function is different from the tuatara's. The jaws, joined by ligament, chew with backwards and forwards movements combined with a shearing up and down action. The force of the bite is suitable for shearing chitin and bone.[2] The double-row arrangement provides a self-sharpening mechanism. The tuatara's teeth are not replaced, since they are not separate structures like real teeth, but sharp projections of the jaw bone. As their teeth wear down, older tuataras have to switch to softer prey such as earthworms, larvae, and slugs, and eventually have to chew their food between

smooth jaw bones.

Sensory organs

In tuataras, both eyes can focus independently, and are specialized with a "duplex retina" that contains two types of visual cells for vision by both day and night , and a tapetum lucidum which reflects on to the retina to enhance vision at night. There is also a third eyelid on each eye, the nictitating membrane.

The tuatara has a third eye on the top of its head called the parietal eye. It has its own lens, cornea, retina with rod-like structures and degenerated nerve connection to the brain, suggesting it evolved from a real eye. The parietal eye is only visible in hatchlings, which have a translucent patch at the top centre of the skull. After four to six months it becomes covered with opaque scales and pigment.[2] Its purpose is unknown, but it may be useful in absorbing ultraviolet rays to manufacture vitamin D,[8] as well as to determine light/dark cycles, and help with thermoregulation.[2] Of all extant tetrapods, the parietal eye is most pronounced in the tuatara.

Together with turtles, the tuatara has the most primitive hearing organs among the amniotes. There is no eardrum, and the middle ear cavity is filled with loose tissue, mostly adipose tissue. The stapes comes into contact with the quadrate (which is immovable) as well as the hyoid and squamosal. The hair cells are unspecialized, innervated by both afferent and efferent nerve fibers, and respond only to low frequencies. Even though the hearing organs are poorly developed and primitive with no visible external ears, they can still show a frequency response from 100-800 Hz, with peak sensitivity of 40 dB at 200 Hz.[9]

Spine and ribs

The tuatara spine is made up of hour-glass shaped amphicoelous vertebrae, concave both before and behind. This is the usual condition of fish vertebrae and some amphibians, but is unique to tuataras within the amniotes.

The tuatara has gastralia, rib-like bones also called gastric or abdominal ribs, the presumed ancestral trait of diapsids. It is found in some lizards (in lizards they are mostly made of cartilage), crocodiles and the tuatara, and are not attached to the spine or thoracic ribs.

The real ribs are small projections, with small, hooked bones, called uncinate processes, found on the rear of each rib. This feature is

also present in birds. The tuatara is the only living tetrapod with well developed gastralia and uncinate processes.

In the early tetrapods, the gastralia and ribs with uncinate processes, together with bony elements such as bony plates in the skin (osteoderms) and clavicles (collar bone), would have formed a sort of exo-skeleton around the body, protecting the belly and helped to hold in the guts and inner organs. These anatomical details most likely evolved from structures involved in locomotion even before the vertebrates migrated onto land. It is also possible the gastralia were involved in the breathing process in primitive and extinct amphibians and reptiles. The pelvis and shoulder girdles are arranged differently than in lizards, as is the case with other parts of the internal anatomy and its scales.

Natural history

Adult tuataras are terrestrial and nocturnal reptiles, though they will often bask in the sun to warm their bodies. Hatchlings hide under logs and stones, and are diurnal, likely because adults are cannibalistic. Tuataras survive in temperatures much lower than those tolerated by most reptiles, and hibernate during winter. They can maintain normal activities at temperatures as low as 7° C, while temperatures over 28° C are generally fatal. The optimal body temperature for the tuatara is from 16 to 21° C, the lowest of any reptile.[10] The body temperature of tuatara is lower than that of other reptiles ranging from 5.2–11.2° C over a day, whereas most reptiles have body temperatures around 20° C.[11] The low body temperature results in a slower metabolism.

Burrowing seabirds such as petrels, prions and shearwaters share the tuataras' island habitat during the bird's nesting season. The tuataras use the bird's burrows for shelter when available, or dig their own. The seabirds' guano helps to maintain invertebrate populations that tuataras predominantly prey on; including beetles, crickets and spiders. Their diet also consists of frogs, lizards and bird's eggs and chicks. Seabirds may provide beneficial fatty acids.[2]

Tuataras reproduce very slowly; taking ten years to reach sexual maturity. Mating occurs in midsummer; females mate and lay eggs once every four years.[12] During courtship, a male makes his skin darker, raises his crests and parades toward the female. He circles himself around the female while slowly walking with stiffened legs. The female will either submit, and allow the male to mount her, or retreat to her burrow. [13] Males do not have a penis; they reproduce by the male lifting the tail of the female and placing his vent over hers. The sperm is then transferred into the female.

Tuatara eggs have a soft, parchment-like shell. It takes the females between one and three years to provide eggs with yolk, and up to seven months to form the shell. It then takes between 12 and 15 months from copulation to hatching. This means reproduction occurs at 2 to 5 year intervals, the slowest in any reptile.[2] The sex of a hatchling depends on the temperature of the egg, with warmer eggs tending to produce male tuataras, and cooler eggs producing females. Eggs incubated at 21° C have an equal chance of being male or female. However, at 22° C, 80% are likely to be males, and at 20° C, 80% are likely to be females; at 18° C all hatchlings will be females.[8] There is some evidence that sex determination in tuataras is determined by both genetic and environmental factors.[14]

Tuataras probably have the slowest growth rates of any reptile,[2]

continuing to grow larger for the first 35 years of their lives.[8] The average lifespan is about 60 years, but they can live to be over 100 years old.[8]

Conservation status

Tuataras, like many native New Zealand animals, are threatened by habitat loss, and introduced species such as mustelids and rats. They were long confined to 32 offshore islands free of mammals.[1] A mainland release occurred in 2005 in the heavily fenced and monitored Karori Wildlife Sanctuary.

Sphenodon guntheri is present naturally on one small island with a population of approximately 400, and has been reintroduced to two others. *Sphenodon punctatus* naturally occurs on 29 islands and its population is estimated to be over 60,000 individuals.[2]

There are several Tuatara breeding programmes within New Zealand. Southland Museum and Art Gallery in Invercargill, was the first to have a tuatara breeding programme; they breed Sphenodon punctatus. Hamilton Zoo and Wellington Zoo also breed tuataras for release into the wild. The Victoria University of Wellington maintains a research programme into the captive breeding of tuataras, and the National Wildlife Centre at Pukaha Mount Bruce keeps a pair and juvenile. The WildNZ Trust has a tuatara breeding enclosure at Ruawai.

Etymology and cultural significance

The name "tuatara" derives from the Mori language, meaning "peaks on the back".[8] Tuataras feature in a number of indigenous legends, and are held as ariki (God forms). Tuataras are regarded as the messengers of Whiro, the god of death and disaster, and Mori women are forbidden to eat them.[15] The tuatara is featured on one side of the New Zealand 5 cent coin, to be phased out in October 2006 [16].

Sphenodon is derived from the Greek language for "wedge" (sphenos) and "tooth" (odon(t)); punctatus is Latin for "spotted"; guntheri alludes to Albert Günther, keeper of Zoology at the British Museum in London.

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Agamidae

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Sauria
Family: **Agamidae**
Subfamilies:
Agaminae
Leiolepidinae
Draconinae

Agamids or lizards of the family **Agamidae** include more than 300 species in Africa, Asia, Australia, and a few in Southern Europe. Phylogenetically they may be sister to the Iguanidae, characterized by predominantly acrodont dentition. Agamids usually have well-developed, strong legs. Their tails cannot be shed and regenerated like those of Geckoes, though a certain amount of regeneration is observed in some. Many agamid species are capable of limited change of their colours. Ecologically they range from hot deserts to tropical rainforests.

There have been very few studies of the Agamidae with the first comprehensive assessment by Moody (1980) followed by a more inclusive assessment by Frost and Etheridge (1989). Subsequent studies were based mitochondrial DNA loci with Macey et al. (2000) and Honda et al. (2000) and Joger (1991)(using allozymes) sampling across the Agamidae. Few other studies focused on clades within the family, but the Agamidae have not been as well investigated as the Iguanidae.

Among the Agamidae, six clades or lineages are generally recognized including the Leiolepidinae (Leiolepis), Uromasticinae (Uromastyx), Amphibolurinae (Australian and New Guinean), Hydrosaurinae (*Hydrosaurus*), Draconinae (South and Southeast Asian), and Agaminae (African and Arabian). The Chamaeleons of the sister family Chamaeleonidae are sometimes discussed as sub-family Chamaeleoninae and sub-family Agaminae (referring to Agamidae, not the Agaminae mentioned above).

Archosaurs

Fossil range: Early Triassic - Recent
Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Subclass: Diapsida
Infraclass: Archosauromorpha
(unranked): **Archosauria,** Cope, 1869

Groups

- Crurotarsi
  - Aetosauria
  - Crocodilia (crocodiles)
  - Phytosauria
  - Rauisuchia
- Ornithodira
  - Pterosauria
  - *Marasuchus*
  - Dinosauria
    - Aves (birds)

Archosaurs (Greek for 'ruling lizards') are a group of diapsid reptiles that first evolved from Archosauriform ancestors during the Olenekian (Lower Triassic Period). They are represented today by birds and crocodiles. Archosaurs are set apart by having socketed teeth (a feature that inspired the traditional name, 'thecodonts', for the Triassic forms) and four-chambered hearts, among other characteristics. Most early forms were carnivores, with narrow serrated meat-tearing teeth. Their "reptilian" metabolism seem to have given them a clear advantage over the mammal-like therapsids that were their contemporaries in the arid interiors and strong monsoon climates that were the natural result of the single world-continent, Pangaea. Thus, whereas the Permian was dominated by synapsids, the Triassic came to be dominated by sauropsids.

There are two primary groups of archosaurs — the Ornithodira which were insignificant during the Middle Triassic but in the Late Triassic radiated as the dinosaurs and pterosaurs; and the Crurotarsi, which were the predominant group at this time, and included a number of purely Triassic groups like the rauisuchians, the phytosaurs, and the herbivorous aetosaurs, as well as the ancestors of the crocodilians.

A number of these archosaur groups - chiefly those large Crurotarsi

that are in pre-cladistic books called the Thecodonts - became extinct 195 million years ago, during the Triassic-Jurassic extinction event. The survivors - the Dinosaurs and the Pterosaurs among the Ornithodira, and first the Sphenosuchia and Protosuchia then their descendants the Crocodilia among the Crurotarsi - flourished during the Jurassic and Cretaceous Periods. The dinosaurs dominated the land, the pterosaurs and later another archosaurian group, the birds, dominated the air,and the crocodiles dominated the rivers and swamps and even invaded the seas (the Teleosaurs and Metriorhynchidae).

Most of these taxa perished 65 million years ago, during the Cretaceous-Tertiary extinction event. The only groups of archosaurs to continue through to the Tertiary and, ultimately, to the present day, are the birds (which are descended from the dinosaurs) and the crocodylia (which include all modern crocodiles, alligators, and gharials).

Birds are traditionally treated as a separate class, Aves, while the rest of the archosaurs are treated as a subclass or infraclass, Archosauria, within the class Reptilia. More recently, with the cladistic method dominating Biology, only monophyletic groups are considered valid and birds are included within the division Archosauria.

Taxonomy

- **Infraclass Archosauromorpha**
  - **(unranked) Archosauriformes**
    - **(unranked) ARCHOSAURIA**
      - **(unranked) Crurotarsi** ("Pseudosuchia")
        - Order Phytosauria
        - Order Aetosauria
        - Order Rauisuchia
          - Order Crocodilia
      - **(unranked) Ornithodira** ("Ornithosuchia" *sensu* Gauthier but without Ornithosuchidae)
        - Order Pterosauria
        - Superorder Dinosauria
          - Class Aves

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Birds | Crocodiles | Dinosaurs | Phytosaurs | Pterosaurs | Archosauriformes | Archosauromorpha | Prolacertiformes

Birds

Fossil range: Late Jurassic - Recent
Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
(unranked) Archosauria
Class: **Aves,** Linnaeus, 1758
Orders: Many - see section below.

Birds are bipedal, warm-blooded, oviparous vertebrate animals characterized primarily by feathers, forelimbs modified as wings, and (in most) hollow bones.

Birds range in size from the tiny hummingbirds to the huge Ostrich and Emu. Depending on the taxonomic viewpoint, there are about 8,800–10,200 living bird species (and about 120–130 that have become extinct in the span of human history) in the world, making them the most diverse class of terrestrial vertebrates.

Birds feed on nectar, plants, seeds, insects, fish, mammals, carrion, or other birds.

Most birds are diurnal, or active during the day, but some birds, such as the owls and nightjars, are nocturnal or crepuscular (active during twilight hours), and many coastal waders feed when the tides are appropriate, by day or night.

Many birds migrate long distances to utilise optimum habitats (e.g., Arctic Tern) while others spend almost all their time at sea (e.g. the Wandering Albatross). Some, such as Common Swifts, stay aloft for days at a time, even sleeping on the wing.

Common characteristics of birds include a bony beak with no teeth, the laying of hard-shelled eggs, high metabolic rate, a 4-chambered heart, and a light but strong skeleton. Most birds are characterised by flight, though the ratites are flightless, and several other species, particularly on islands, have also lost this ability. Flightless birds include the penguins, ostrich, kiwi, and the extinct Dodo. Flightless species are vulnerable to extinction when humans or the mammals they introduce arrive in their habitat. The Great Auk, flightless rails, and the moa of New Zealand, for example, all became extinct due to human influence.

Birds are among the most extensively studied of all animal groups. Hundreds of academic journals and thousands of scientists are devoted to bird research, while amateur enthusiasts (called birdwatchers, twitchers or, more commonly, birders) probably number in the millions.

Contents

High-level taxonomy

Birds are categorised as a biological class, Aves. The earliest known species of this class is Archaeopteryx lithographica, from the Late Jurassic period. Modern phylogenies place birds in the dinosaur clade Theropoda. According to the current consensus, Aves and a sister group, the order Crocodilia, together are the sole living members of an unranked "reptile" clade, the Archosauria.

Phylogenetically, Aves is usually defined as all descendants of the most recent common ancestor of modern birds (or of a specific modern bird species like Passer domesticus), and Archaeopteryx.

Modern birds are divided into two superorders, the Paleognathae (mostly flightless birds like ostriches), and the wildly diverse Neognathae, containing all other birds.

Bird orders

This is a list of the taxonomic orders in the subclass Neornithes, or modern birds. The list of birds gives a more detailed summary of these, including families.

SUBCLASS NEORNITHES

Paleognathae:

- Struthioniformes, Ostrich, emus, kiwis, and allies
  Tinamiformes, tinamous

Neognathae:

- Anseriformes, waterfowl
  Galliformes, fowl
  Gaviiformes, loons
  Podicipediformes, grebes
  Procellariiformes, albatrosses, petrels, and allies
  Sphenisciformes, penguins
  Pelecaniformes, pelicans and allies
  Ciconiiformes, storks and allies
  Phoenicopteriformes, flamingos
  Accipitriformes, eagles, hawks and allies
  Falconiformes, falcons
  Gruiformes, cranes and allies
  Charadriiformes, gulls, button-quail, plovers and allies
  Pteroclidiformes, sandgrouse
  Columbiformes, doves and pigeons
  Psittaciformes, parrots and allies
  Cuculiformes, cuckoos, turacos, hoatzin
  Strigiformes, owls
  Caprimulgiformes, nightjars and allies
  Apodiformes, swifts and hummingbirds
  Coraciiformes, kingfishers
  Piciformes, woodpeckers and allies
  Trogoniformes, trogons
  Coliiformes, mousebirds
  Passeriformes, passerines

Note: This is the traditional classification (the so-called Clements order). A radically different classification based on molecular data has been developed (the so-called Sibley-Monroe classification or Sibley-Ahlquist taxonomy). This has influenced taxonomical thinking considerably, with the Galloanserae proving well-supported by recent

molecular, fossil and anatomical evidence. With increasingly good evidence, it has become possible by 2006 to test the major proposals of the Sibley-Ahlquist taxonomy. The results are often nothing short of astounding, see e.g. Charadriiformes or Caprimulgiformes.

Extinct bird orders

A wide variety of bird groups became extinct during the Mesozoic era and left no modern descendants. These include the orders Archaeopterygiformes, Confuciusornithiformes, toothed seabirds like the Hesperornithes and Ichthyornithes, and the diverse subclass Enantiornithes ("opposite birds").

For a complete listing of prehistoric bird groups

Evolution

There is significant evidence that birds evolved from theropod dinosaurs, specifically, that birds are members of Maniraptora, a group of theropods which includes dromaeosaurs and oviraptorids, among others.[1] As more non-avian theropods that are closely related to birds are discovered, the formerly clear distinction between non-birds and birds becomes less so. Recent discoveries in northeast the People's Republic of China (Liaoning Province), demonstrating that many small theropod dinosaurs had feathers, contribute to this ambiguity.

The basal bird Archaeopteryx, from the Jurassic, is well-known as one of the first "missing links" to be found in support of evolution in the late 19th century, though it is not considered a direct ancestor of modern birds. Confuciusornis is another early bird; it lived in the Early Cretaceous. Both may be predated by Protoavis texensis, though the fragmentary nature of this fossil leaves it open to considerable doubt if this was a bird ancestor. Other Mesozoic birds include the Enantiornithes, Yanornis, Ichthyornis, Gansus and the Hesperornithiformes, a group of flightless divers resembling grebes and loons.

The recently discovered dromaeosaur Cryptovolans was capable of powered flight, possessed a sternal keel and had ribs with uncinate processes. In fact, Cryptovolans makes a better "bird" than Archaeopteryx which is missing some of these modern bird features. Because of this, some paleontologists have suggested that dromaeosaurs are actually basal birds whose larger members are secondarily flightless, i.e. that dromaeosaurs evolved from birds and not the other way around. Evidence for this theory is currently inconclusive, but digs continue to unearth fossils (especially in China) of the strange feathered dromaeosaurs. At any rate, it is fairly certain that avian flight existed in the mid-Jurassic and was "tried out" in several lineages and variants by the mid-Cretaceous.

Although ornithischian (bird-hipped) dinosaurs share the same hip structure as birds, birds actually originated from the saurischian (lizard-hipped) dinosaurs (if the dinosaurian origin theory is correct), and thus arrived at their hip structure condition independently. In fact, the bird-like hip structure also developed a third time among a peculiar group of theropods, the Therizinosauridae.

An alternate theory to the dinosaurian origin of birds, espoused by a few scientists (most notably Lary Martin and Alan Feduccia), states that birds (including maniraptoran "dinosaurs") evolved from early archosaurs like Longisquama, a theory which is contested by most

other scientists in paleontology, and by experts in feather development and evolution such as R.O. Prum. See the Longisquama article for more on this alternative.

Modern birds are classified in Neornithes, which are now known to have evolved into some basic lineages by the end of the Cretaceous (see Vegavis). The Neornithes are split into the Paleognathae and Neognathae. The paleognaths include the tinamous (found only in Central and South America) and the ratites. The ratites are large flightless birds, and include ostriches, cassowaries, kiwis and emus (though some scientists suspect that the ratites represent an artificial grouping of birds which have independently lost the ability to fly in a number of unrelated lineages). The basal divergence from the remaining Neognathes was that of the Galloanseri, the superorder containing the Anseriformes (ducks, geese and swans), and the Galliformes (the pheasants, grouse, and their allies). See the chart for more information.

The classification of birds is a contentious issue. Sibley & Ahlquist's Phylogeny and Classification of Birds (1990) is a landmark work on the classification of birds (although frequently debated and constantly revised). A preponderance of evidence seems to suggest that the modern bird orders constitute accurate taxa. However, scientists are not in agreement as to the relationships between the orders; evidence from modern bird anatomy, fossils and DNA have all been brought to bear on the problem but no strong consensus has emerged. More recently, new fossil and molecular evidence is providing an increasingly clear picture of the evolution of modern bird orders. See also: Sibley-Ahlquist taxonomy.

Bird anatomy

Birds have a body plan that shows so many unusual adaptations (mostly aiding flight) that birds have earned their own unique class in the vertebrate phylum.

Unlike mammals, birds don't urinate. Their kidneys extract nitrogenous wastes from the bloodstream, but instead of excreting it as urea dissolved in urine as we do, they excrete it in the form of uric acid. Uric acid has a very low solubility in water, so it emerges as a white paste. This material, as well as the output of the intestines, emerges from the bird's cloaca. The cloaca is a multi-purpose hole for birds: their wastes come out of it, they have sex by putting their cloacas together, and females lay eggs out of it.

Nesting

Eggs

All birds lay amniotic eggs[2] with hard shells made mostly of calcium carbonate. Non-passerines typically have white eggs, except in some ground-nesting groups such as the Charadriiformes, sandgrouse and nightjars, where camouflage is necessary, and some parasitic cuckoos which have to match the passerine host's egg. Most passerines, in contrast, lay coloured eggs, even if, like the tits they are hole-nesters.

The brown or red protoporphyrin markings on passerine eggs reduce brittleness and are a substitute for calcium when that element is in short supply. The colour of individual eggs is genetically influenced, and appears to be inherited through the mother only, suggesting that the gene responsible for pigmentation is on the sex determining W chromosome (female birds are WZ, males ZZ).

The eggs are laid in a nest, which may be anything from a bare cliff ledge or ground scrape to elaboratey decorated structures such as those of the oropendolas.

Social systems and parental care

The three mating systems that predominate among birds are polyandry, polygyny, and monogamy. Monogamy is seen in approximately 91% of all bird species. Polygyny constitutes 2% of all birds and polyandry is seen in less than 1%. Monogamous species of males and females pair for the breeding season. In some cases, the individuals may pair for life.

One reason for the high rate of monogamy among birds is the fact that male birds are just as adept at parental care as females. In most groups of animals, male parental care is rare, but in birds it is quite common; in fact, it is more extensive in birds than in any other vertebrate class. In birds, male care can be seen as important or essential to female fitness. "In one form of monogamy such as with obligate monogamy a female cannot rear a litter without the aid of a male" [3].

The parental behavior most closely associated with monogamy is male incubation. Interestingly, male incubation is the most confining

male parental behavior. It takes time and also may require physiological changes that interfere with continued mating. This extreme loss of mating opportunities leads to a reduction in reproductive success among incubating males. "This information then suggests that sexual selection may be less intense in taxa where males incubate, hypothetically because males allocate more effort to parental care and less to mating" [4]. In other words, in bird species in which male incubation is common, females tend to select mates on the basis of parental behaviors rather than physical appearance.

Birds and humans

Birds are an important food source for humans. The most commonly eaten species is the domestic chicken and its eggs, although geese, pheasants, turkeys, and ducks are also widely eaten. Other birds that have been utilized for food include emus, ostriches, pigeons, grouse, quails, doves, woodcocks, songbirds, and others, including small passerines such as finches. Birds grown for human consumption are referred to as poultry.

At one time swans and flamingos were delicacies of the rich and powerful, although these are generally protected now.

Besides meat and eggs, birds provide other items useful to humans, including feathers for bedding and decoration, guano-derived phosphorus and nitrogen used in fertilizer and gunpowder, and the central ingredient of bird's nest soup.

Humans have caused the disappearance of some bird species. The Passenger Pigeon and Dodo were hunted to extinction, and many others have become endangered or extinct through habitat destruction (e.g. by deforestation or intensive agriculture).

Some species have come to depend on human activities for food and are widespread to the point of being pests. For example, the common pigeon or Rock Pigeon (Columba livia) thrives in urban areas around the world. In North America, introduced House Sparrows, European Starlings, and House Finches are similarly widespread.

Other birds have long been used by humans to perform tasks. For example, homing pigeons were used to carry messages before the advent of modern instant communications methods (many are still kept for sport). Falcons are still used for hunting, while cormorants are employed by fishermen. Chickens and pigeons are popular as experimental subjects, and are often used in biology and comparative psychology research. As birds are very sensitive to toxins, the Canary was used in coal mines to indicate the presence of poisonous gases, allowing miners sufficient time to escape without injury.

Colorful, particularly tropical, birds (e.g. parrots, and mynas) are often kept as pets although this practice has led to the illegal trafficking of some endangered species; CITES, an international agreement adopted in 1963, has considerably reduced trafficking in the bird species it protects.

Bird diseases that can be contracted by humans include psittacosis, salmonellosis, campylobacteriosis, Newcastle's disease, mycobacteriosis (avian tuberculosis), avian influenza, giardiasis, and cryptosporidiosis.

Threats to birds

According to Worldwatch Institute, bird populations are declining worldwide, with 1,200 species facing extinction in the next century. [5] Among the biggest cited reasons are habitat loss,[6] predation by nonnative species,[7] oil spills and pesticide use, hunting and fishing, and climate change.

Trivia

- To preen or groom their feathers, birds use their bills to brush away foreign particles.
- The birds of a region are called the **avifauna**.
- Few birds use chemical defences against predators. Tubenoses can eject an unpleasant oil against an aggressor, and some species of pitohui, found in New Guinea, secrete a powerful neurotoxin in their skin and feathers.
- The Latin word for bird is **avis**.

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Crocodiles

Crocodilia

Fossil range: Triassic - Recent

Kingdom: Animalia

Phylum: Chordata

Class: Sauropsida

Order: **Crocodilia,** Owen, 1842

Suborders

Eusuchia

Protosuchia †

Mesosuchia †

Sebecosuchia †

Thalattosuchia †

Crocodilia is an order of large reptiles that appeared about 220 million years ago. They are the closest living relatives of birds, as the two groups are the only survivors of the Archosauria.[1]

Contents

Spelling

The group is often spelled 'Crocodylia' for consistency with the genus Crocodylus Laurenti, 1768. However, Richard Owen used the -i- spelling when he published the name in 1842, so by the usual rules of scientific classification his name has priority. In any case, the -i- spelling is a more accurate Latinization of the Greek ºÁ¿ºÌ´µ¹»¿Â (*krokodeilos*, literally "pebble-worm", referring to the shape and texture of the animal).

Description

Like mammals and unlike most other reptiles (with the notable exception of monitor lizards), crocodiles have a four-chambered heart; however, unlike mammals, oxygenated and deoxygenated blood can be mixed when the *foramen of Panazzi* is open, which bridges both ventricles in the heart. The foramen is typically only open during diving, in order to shunt blood away from the lungs. Their blood has shown to have strong antibacterial properties.

All crocodilians have, like *Homo sapiens* (humans), thecodont dentition (teeth set in bony sockets) but unlike mammals, they replace their teeth throughout life (though not in 'extreme' old-age). Juvenile crocodilians replace teeth with larger ones at a rate as high as 1 new tooth per socket every month. After reaching adult size in a few years, however, tooth replacement rates can slow to two years and even longer. Very old members of some species have been seen in an almost "edentulous" (toothless) state, after teeth have been broken and replacement slowed or ceased. The result of this is that a single crocodile can go through at least 3,000 teeth in its lifetime. Each tooth is hollow, and the new one is growing inside the old. In this way, a new tooth is ready once the old is lost.

Crocodilians have a secondary bony palate that enables them to breathe when partially submerged, even if the mouth is full of water. Their internal nostrils open in the back of their throat, where a special part of the tongue called the "palatal valve" closes off their respiratory system when they are underwater. This way they can open their mouths underwater without choking. Most reptiles lack a secondary palate, but some skinks (family Scincidae) have evolved a bony secondary palate too, to varying degrees.

The tongue is attached to the floor of its mouth, making it hard to move at all.

They lack a vomeronasal organ (yet it is detectable in the embryo) and a urinary bladder.

They have alveoli in their lungs and a unique muscular attachment to the liver and viscera that acts as a piston to breathing, separating the thoracic and abdominal cavities (similar to the diaphragm of mammals). Although tegu lizards have a primitive proto-diaphragm, separating the pulmonary cavity from the visceral cavity and allowing greater lung inflation, this has a different evolutionary history.

Like all reptiles they have a relatively small brain, but it is more advanced than in other reptiles. Among other things it has a true cerebral cortex.

Crocodiles are often seen lying with their mouths open, a behavior

called gaping. One of its functions is probably to cool them down, but since they also do this at night and when it is raining, it is possible that gaping has a social function too.

The crocodile basic body plan is a very successful one. Their form is well-adapted to their semi-aquatic niche, which is why modern forms look similar today as they did when the dinosaurs were still around (though only to the semi-aquatic forms). Mammals too have adapted to this body plan at least once in history. One ancestral whales family, Ambulocetidae, was an aquatic predator living in rivers and lakes. Ambulocetids filled an ecological niche similar to the modern crocodiles.

They have a semi-erect (semi-sprawled) posture, holding their legs more directly underneath them than most other reptiles (the chameleons are probably the only reptiles with a more erect posture than Crocodylia). This makes it possible for some species to even gallop on land if necessary; an Australian species can reach a speed of over 16 km/h while galloping on an irregular forest floor. But their ancestors actually had a fully erect posture; their sprawling and semi-erect posture are secondary and evolved after they adapted to a life in water as ambush predators. Their the ankle bones (tarsals) are highly modified. In other words, their locomotion is not primitive, it is in fact specialised to their semi-aquatic lifestyle. Their distant ancestors were fast-moving terrestrial predators, like Junggarsuchus sloani. An extinct terrestrial species, Pristichampsus rollinatii, even had hoof-like toes.

As in many other aquatic or amphibian tetrapods, the eyes, ears, and nostrils are all located on the same plane. They see well during the day and may even have colour vision, plus the eyes have a vertical, cat-like pupil which also gives them excellent night vision. The iris is silvery (light reflecting layer of tapetum behind the retina greatly increases their ability to see in weak light) also makes their eyes glow in the dark. A third transperant eyelid, the nictitating membrane, protects their eyes underwater. However, they cannot focus under water, meaning other senses are more important when submerged under water.

While birds and most reptiles have a ring of bones around each eye which supports the eyeball (the sclerotic ring), the crocodiles lack these bones, just like mammals and snakes. The eardrums are located behind the eyes and are covered by a movable flap of skin. This flap closes, along with the nostrils and eyes, when they dive, preventing water from entering their external head openings. The middle ear cavity has a complex of bony air-filled passages and a branching eustachian tube. There is also a small muscle (which is also seen in gecko) next to or upon the stapes, the stapedius, which probably functions in the same way as the mammalian stapedius muscle does,

dampening strong vibrations.

The gender of the juvenile is determined by the incubation temperature. This means crocodilians do not have genetic sex determnination (like us), but a form of environmental sex determination which is based upon temperature embryo's undergo early in their development.

The skin is covered with non-overlapping scales composed of the protein keratin (the same protein that forms hoofs, skin, horns, feathers, hair, claws and nails in other tetrapods), which are shed individually. On the head the skin is actually fused to the bones of the skull. There are small plates of bone, called osteoderms or scutes, under the scales. Just like a tree, crocodile osteoderms have annual growth rings, and by counting them it is possible to tell their age. Osteoderms are found especially on the back, and in some species also on the belly. The overlapping rows of scutes cover the crocodile's body from head to tail, forming a tough protective armor. Beneath the scales and osteoderms is another layer of armor, both strong and flexible and built of rows of bony overlapping shingles called osteoscutes, which are embedded in the animal's back tissue. The blood-rich bumpy scales seen on their backs acts as solar panels.

Their spool-shaped vertebrae in their ancestors went from being biconcave to having a concave front and a convex back in the modern forms. This made the vertebral column more flexible and strong, a useful adaptation if you are hunting in water.

They possess ribs of dermal origin restricted to the sides of the ventral body wall. The collar bone (clavicle) is absent.

Crocodiles and gharials have modified salivary glands on their tongue (salt glands), which are used for excreting excess salt ions from their body. Alligators and caimans have them too, but here they are non-functioning. This indicates that at some point the common origin of the Crocodylia were adapted to saline/marine environments. This also explains their wide disribution across the continents (i.e. marine dispersal). Species like the saltwater crocodile (*C. porosus*) can survive protracted periods of time in the sea, and can hunt prey within this environment.

Crocodylians are known to swallow stones, gastroliths ("stomach-stones"), which act as a ballast in addition to aiding post-digestion processing of their prey. The crocodiylian stomach is divided into two chambers, the first one is described as being powerful and muscular, like a bird gizzard. This is where the gastroliths are found. The other stomach has the most acidic digestive system of any animal, and it can digest mostly everything from their prey; bones, feathers and horns.

The upper and lower jaws are covered with sensory pits, seen as small, black speckles on the skin, the crocodile version of the lateral

organ we see in fish and many amphibians. But they have a completely different origin. These pigmented nodules encase bundles of nerve fibers that respond to the slightest disturbance in surface water, detecting vibrations and small pressure changes in water, making it possible for them to detect prey, danger and intruders even in total darkness. These sense organs are known as DPRs (Dermal Pressure Receptors). While alligators and caimans only have them on their jaws, crocodiles have similar organs on almost every scale on their body. The function of the DPRs on the jaws are clear, but it is still not quite clear what the organs on the rest of the body in crocodiles actually do. They are probably doing the same as the organs on their jaws, but it seems like they can do more than that, like assisting in chemical reception or even salinity detection.

Evolution

When their extinct species and stem group are examined, crocodylians prove to have been a very diverse and adaptive group of reptiles. Not only are an ancient group of animals, at least as old as the dinosaurs, they also evolved into a great variety of forms. The earliest forms, the Sphenosuchians, evolved during the Late Triassic, and were highly gracile terrestrial forms built like greyhounds. Several terrestrial species during the Cretaceous evolved herbivory, such as Simosuchus clarki and Chimaerasuchus paradoxus. During the Jurassic and the Cretaceous marine forms in the family Metriorhynchidae such as Metriorhynchus evolved forelimbs that were paddle-like and had a tail similar to modern fish. Dakosaurus andiniensis a closely related species to *Metriorhynchus* had a skull that was adapted to eat large marine reptiles.

Eusuchia, a modern clade which includes the crown group Crocodylia, first appeared in the Lower Cretaceous of Europe. The recently-described fossil, Isisfordia duncani, lived approximately 95 to 98 million years ago, during the Cenomanian epoch of the Upper Cretaceous. Isisfordia is the second oldest known eusuchian, and the earliest crocodylian yet found in Australia. Eusuchians underwent a mass radiation during the Late Cretaceous and the Paleogene, in which they evolved into numerous forms, such as semi-aquatic dinosaur-eating species (Deinosuchus); hooved, terrestrial carnivores (Pristichampus), and 'hatchet'-shaped skulled forms (Baru).

n popular Culture

- Several science fiction movies have giant crocodilians as their stars, such as Lake Placid, DinoCroc, and the crocodile series.

Extinct species

- **Superorder Crocodylomorpha**
  - **(unranked) Sphenosuchia**
    - Family Terrestrisuchidae
      Family Sphenosuchidae
  - **(unranked) Crocodyliformes**
    - Family Shartegosuchidae
    - **(unranked) Protosuchia**
      - Family Protosuchidae
    - **(unranked) Mesoeucrocodylia**
      - Family Hsisosuchidae
        Family Gobiosuchidae
      - Suborder Thalattosuchia
        - Family Teleosauridae
          Family Metriorhynchidae
      - Suborder Metasuchia
        - (unranked) Notosuchia
          - Family Notosuchidae
            Family Sebecosuchidae
            Family Baurusuchidae
        - **(unranked) Neosuchia**
          - Family Trematochampsidae
            Family Peirosauridae
            Family Atoposauridae
            Family Dyrosauridae
            Family Pholidosauridae
            Family Goniopholididae
          - Family Paralligatoridae
            - **(unranked) Eusuchia (see below)**

Modern species

See individual family pages for a full list of species.

- **(unranked) Eusuchia**
  - Genus *Hylaeochampsa* (extinct)
  - Genus *Allodaposuchus* (extinct)
    - Genus Borealosuchus (extinct)
      Genus Pristichampsus (extinct)
    - **Superfamily Gavialoidea**
      - **Family Gavialidae**
        - Genus Gavialis - Gharial/Gavial
          Genus Tomistoma - False Gharial/Gavial
    - **Superfamily Crocodyloidea**
      - **Family Mekosuchidae** (extinct)
      - **Family Crocodylidae**
        - Subfamily Crocodylinae - Crocodiles
    - **Superfamily Alligatoroidea**
      - **Family Nettosuchidae** (extinct)
      - **Family Alligatoridae**
        - Subfamily Alligatorinae - Alligators
        - Subfamily Caimaninae - Caimans

Alligator | Crocodile

Alligator

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Crocodilia
Family: Alligatoridae
Genus: ***Alligator,*** Daudin, 1809
Species
Alligator mississippiensis
Alligator sinensis

An **alligator** is a crocodilian in the genus ***Alligator*** of the family Alligatoridae. The name alligator is an anglicized form of the Spanish el lagarto ("the lizard"), the name by which early Spanish explorers and settlers in Florida called the alligator. There are two living alligator species: the American Alligator (*Alligator mississippiensis*) and the Chinese Alligator (*Alligator sinensis*).

Contents

Description

Alligators are characterized by a broader snout and eyes more dorsally located than their crocodile cousins. Both living species also tend to be darker in color, often nearly black (although the Chinese alligator has some light patterning.) Also, in alligators only the upper teeth can be seen with the jaws closed (in contrast to true crocodiles, in which upper and lower teeth can be seen), though many individuals bear jaw deformities which complicate this means of identification.

The eyes of an alligator glow red when a light is shined on them. This fact can be used to find alligators in the dark.

According to the Everglades National Park website, the largest alligator ever recorded in Florida was 17 feet 5 inches long (5.3 meters). The largest alligator ever recorded measured 19 feet 2 inches (5.8 meters) and was found on Marsh Island, Louisiana.[1] Few of the giant specimens were weighed, but the larger ones could have exceeded a ton in weight.

Habitat

There are only two countries on earth that have alligators: the United States and China. The Chinese alligator is endangered and lives only in the Yangtze River valley. The American Alligator is found in the United States from the Carolinas to Florida and along the Gulf Coast. The majority of American Alligators inhabit Florida and Louisiana. In Florida alone there are an estimated more than 1 million alligators. The United States is the only nation on earth where both alligators and crocodiles live side by side. American Alligators live in freshwater environments, such as ponds, marshes, wetlands, rivers, and swamps. In China, they live only along the fresh water of the Yangtze River.

Behavior

Alligators are solitary, territorial animals. The largest of the species (both males and females), will defend prime territory; smaller alligators have a higher tolerance of other alligators within a similar size class.

Although alligators have heavy bodies and slow metabolisms, they are capable of short bursts of speed that can exceed 30 miles per hour. [2] Alligators' main prey are smaller animals that they can kill and eat with a single bite. Alligators may kill larger prey by grabbing it and dragging it in the water to drown. Alligators consume food that cannot be eaten in one bite by allowing it to rot or by biting and then spinning or convulsing wildly until bite size pieces are torn off. This is referred to as the "death roll."

Diet

Alligators are opportunistic feeders, eating almost anything they can catch. When they are young they eat fish, insects, snails, and crustaceans. As they grow they take progressively larger prey items, including: larger fish such as gar, turtles, various mammals, birds, and other reptiles. They will even consume carrion if they are sufficiently hungry. Adult alligators can take razorbacks and deer and are well known to kill and eat smaller alligators. In some cases, larger alligators have been known to hunt the Florida panther and bears, making it the apex predator throughout its distribution. As humans encroach onto to their habitat, attacks on humans are few but not unknown. Alligators, unlike the large crocodiles, do not immediately regard a human upon encounter as prey.

Unfortunately, human deaths caused by alligators have increased. While there were only 9 fatal attacks in the U.S.A. from the 1970s to the 1990s, 11 people were killed by alligators from 2001 to 2006. More deaths occurred in this 5-year period than did in the previous 30. For a long time people have been taught that alligators fear humans, which is true, but this has led some people to be foolhardy and enter the animal's habitat in ways that provoke aggression.

Reproduction

Alligators are seasonal breeders. The mating season is in spring when the water warms. The female builds a nest of vegetation that rots, incubating the eggs. The mother will defend the nest from predators and will assist the babies to water once they hatch. She will provide protection to the young for about a year if they remain in the area.

Farming

Alligator farming is a big and growing industry in Florida, Texas and Louisiana. These states produce a combined annual total of some 45,000 alligator hides. Alligator hides bring good prices and hides in the 6-7 foot range sell for $300 each. The market for alligator meat is growing and approximately 300,000 pounds of meat is produced annually.

References

1. ^ Louisiana Fur and Alligator Advisory Council
2. ^ Everglades National Park: Alligator Size, Weight & Speed

Crocodile

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Crocodilia
Family: **Crocodylidae,** Cuvier, 1807
Genera
Mecistops
Crocodylus
Osteolaemus

See full taxonomy.

A **crocodile** is any species belonging to the family **Crocodylidae** (sometimes classified instead as the subfamily **Crocodylinae**). The term can also be used more loosely to include all members of the order Crocodilia: i.e. the true crocodiles, the alligators and caimans (family Alligatoridae) and the gharials (family Gavialidae). The crocodiles, colloquially called crocs, are large aquatic reptiles that live throughout the Tropics in Africa, Asia, the Americas and Australia. Crocodiles tend to congregate in freshwater habitats like rivers and lakes and wetlands and sometimes in brackish water. Some species, notably the Saltwater Crocodile of Australia, Southeast Asia and the Pacific islands often lives along the coastal areas as its name implies. It is also known to venture far out to sea. They mostly feed on a wide variety of vertebrates like fish, reptiles, and mammals, sometimes with invertebrates like mollusks and crustaceans, depending on species. They are an ancient lineage, and are believed to have changed little since the time of the dinosaurs.

Contents

Appearance and physical traits

Crocodiles are the most advanced of all reptiles despite their prehistoric look. Unlike other reptiles they have a four-chambered heart, diaphragm and cerebral cortex. Their external morphology on the other hand is a sign of their aquatic and predatory lifestyle. A crocodile’s physical traits allow it to be a successful predator. They have a streamlined body that enables them to swim faster. They also tuck their feet to their sides while swimming, which makes the animal even faster, by decreasing the amount of water resistance. They have webbed feet, although not used to propel the animal through the water, this allows it to make fast turns and sudden moves in the water or initiate swimming. Webbed feet are an advantage in shallower water where the animals sometimes move around by walking.

Crocodiles are very fast over short distances, even out of water. They have extremely powerful jaws and sharp teeth for tearing flesh, but cannot open their mouth if it is held closed, hence there are stories of people escaping from the long-snouted Nile Crocodile by holding its jaws shut. Indeed, zoologists will often subdue crocodiles for study or transport by taping their jaws or holding their jaws shut with large rubber bands cut from automobile inner tubes. All large crocodiles also have sharp welters and powerful claws. They have limited lateral movement in their neck, so on land one can find protection by getting even a small tree between the crocodile's jaws and oneself.

Age

There is currently no reliable way of measuring crocodile age, although several techniques can be used to derive a reasonable guess. The most common method is to measure lamellar growth rings in bones and teeth - each ring corresponds to a change in growth rate which typically occurs once a year between dry and wet seasons. Bearing these inaccuracies in mind, the oldest crocodilians appear to be the largest species. C. porosus is estimated to live around 70 years on average, and there is limited evidence that some individuals may exceed 100 years. One of the oldest crocodiles recorded died in a zoo in Russia apparently aged 115 years old. The news report did not identify the species.

Size

Size greatly varies between species. From the exceptionally small dwarf crocodile to the enormous saltwater crocodile, they range in all sorts of sizes. Large species can often reach huge sizes over 5 or 6 metres and weigh well over 1000kg. Despite their large adult size, crocodiles start their life interestingly small. Crocodiles when first hatched are around 20 cm. Sizes vary depending on the season and health and blood composition of the mother. The largest species of crocodile, also Earth's largest reptile, is the Saltwater Crocodile, found in northern Australia and throughout South-east Asia. According to some scientists, there are no truly reliable records of any non-prehistoric crocodiles over 8.64m.

In the town of Normanton, Queensland, Australia, there is a fibreglass mould of a crocodile called "Krys the Croc.," shot in 1958 by Krystina Pawloski, who found the animal on a sandbank on the Norman River. There is a report of a saltwater crocodile in Australia that was 8.2 m long. There is also a skull of a salt water crocodile from Orissa, India that is very large and the animal is estimated to have been 6.4 to 7 m long.

The other two larger certifiable records of complete crocodile are both of 6.2 m crocodiles. The first crocodile was shot in the Mary River in the Northern Territory of Australia in 1974 by poachers and measured by wildlife rangers. The second crocodile was killed in 1983 in the Fly River, Papua New Guinea. In this latter crocodile it was actually the skin that was measured by zoologist Jerome Montague, and as skins are known to underestimate the size of the actual animal, it is possible this crocodile was at least another 10 cm longer.

The largest crocodile ever held in captivity is an Estuarine/Siamese hybrid named Yai (Thai: C+ H, meaning *big*) (born 10 June, 1972) at the famous Samutprakarn Crocodile Farm and Zoo, Thailand. He measures 6 m. in length and weighs 1,114.27 kg.

Another huge captive crocodile was a saltie named Gomek. Gomek was captured by George Craig in Papua New Guinea and sold to St. Augustine Alligator Farm in Florida. Although George captured an even larger crocodile with Gomek, it is uncertain whether this animal is still alive on Green Island in Queensland where George Craig now lives. After many years, Gomek died of heart disease in February 1997. By this stage, he was a very old crocodile. When he died, he was 5.5 m long - as confirmed by St. Augustine Alligator Farm - and probably between 70 and 80 years old.

On June 16, 2006, A 7.1m giant saltwater crocodile in Orissa, India was crowned the world's largest living crocodile. It lives in Bhitarkanika Wildlife Sanctuary and in June 2006, was entered in the Guinness Book of World Records. [1]

Wildlife experts, however, argued that the largest crocodile so far

found in the Bhitarkanika was almost 7.62 m which could be traced from the skull preserved by the Kanika Royal Family. The crocodile, probably was shot dead near Dhamara during 1926 and later its skull was preserved by the then Kanika King. The crocodile experts said as per the parameters, the crocodile would be about 7.62 m since the size of the skull was measured one seventh of the total length of the body.

Biology and Behaviour

Crocodiles are ambush hunters, waiting for fish or land animals to come close, then rushing out to attack. As cold-blooded predators, they can survive long periods without food, and rarely need to actively go hunting. The crocodile's bite strength is up to 3,000 pounds per square inch, comparing to just 100 psi for a labrador retriever or 350 psi for a large shark. Despite their slow appearance, crocodiles are the top predators in their environment, and various species have been observed attacking and killing big cats like lions , large ungulates and even sharks. A famous exception is the Egyptian Plover which is said to enjoy a symbiotic relationship with the crocodile. According to unauthenticated reports, the plover feeds on parasites that infest the crocodile's mouth and the reptile will open its jaws and allow the bird to enter to clean out the mouth.

Crocodiles eat fish, birds, mammals and occasionally smaller crocodiles. Wild crocodiles are protected in many parts of the world, but they also are farmed commercially. Their hide is tanned and used to make leather goods such as shoes and handbags, whilst crocodile meat is also considered a delicacy in many parts of the world. The most commonly farmed species are the Saltwater and Nile crocodiles, while a hybrid of the Saltwater and the rare Siamese Crocodile is also bred in Asian farms. Farming has resulted in an increase in the Saltwater Crocodile population in Australia, as eggs are usually harvested from the wild, so landowners have an incentive to conserve crocodile habitat. Crocodiles are more closely related to birds and dinosaurs than to most animals classified as reptiles , the three being included in the group Archosauria ('ruling reptiles'). See Crocodilia for more information.

Danger to humans

The larger species of crocodiles can be very dangerous to humans. The Saltwater and Nile Crocodiles are the most dangerous, killing hundreds of people each year in parts of South-East Asia and Africa. Mugger crocodiles and possibly the endangered Black Caiman, are also very dangerous to humans. American alligators are less aggressive and rarely assault humans without provocation. Crocodiles are the leading cause of animal related deaths as of 2001.

Crocodile blood

Scientists in the United States have isolated a powerful agent in crocodile blood (crocodillin) which could help conquer human infections immune to standard antibiotics. The discovery was made thanks to the curiosity of Jill Fullerton-Smith, a BBC science producer filming a documentary on salt-water crocodiles in Australia.

Crocodile as food

In some countries such as Australia, Thailand and South Africa, the consumption of crocodile meat can be observed. The meat is white and its nutritional composition compares favourably with that of more traditional meats. It does tend to have a slightly higher cholesterol level than other meats. Crocodile meat has a delicate flavour and its taste can be complemented, if not masked, by the use of powerful marinades. Choice cuts of meat include backstrap and tail fillet.

Trivia

- The crocodile gets its name from the Greeks who observed them in the Nile river. The Greeks called them krokodilos, a compound word from kroke, which means "pebbles" and drilos, which means "worm". To the Greeks, this "worm of the stones" was so named because of the crocodiles habit of basking in the sun on gravel-covered river banks.

- Petsuchos was the name given by the Greeks to the live crocodile at Crocodilopolis in Ancient Egypt, which was worshipped as a manifestation of the Egyptian god Sobek; the deification of crocodiles.

- Crocodile embryos do not have sex chromosomes, and unlike humans sex is not determined genetically. Sex is determined by temperature, with males produced at around 31.6 degrees celsius, and females produced at slightly lower and higher temperatures. The average incubation period is around 80 days, and also is dependent upon temperature.

- Many of the extinct crocodiles were herbivorous.

Taxonomy of the Crocodylidae

Most species are grouped into the genus *Crocodylus*. The two other living genera of this family are both monotypic: Osteolaemus and Tomistoma.

- FAMILY CROCODYLIDAE
    - **Subfamily Mekosuchinae** (extinct)
    - **Subfamily Crocodylinae**
        - Genus *Euthecodon* (extinct)
        - Genus *Osteolaemus*
            - Dwarf Crocodile, *Osteolaemus tetraspis* (there has been some controversy whether or not this is actually two species; current thinking is that there is one species with 2 subspecies: O. tetraspis tetraspis & O. t. osborni)
        - Genus *Crocodylus*
            - American Crocodile, Crocodylus acutus
              Slender-snouted Crocodile, Crocodylus cataphractus (Recent DNA studies suggest that this species may actually be more basal than Crocodylus, and belong in its own genus, Mecistops)
              Orinoco Crocodile, Crocodylus intermedius
              Freshwater Crocodile, Crocodylus johnstoni
              Philippine Crocodile, Crocodylus mindorensis
              Morelet's Crocodile or Mexican Crocodile, Crocodylus moreletii
              Nile Crocodile or African Crocodile, Crocodylus niloticus (the subspecies found in Madagascar is sometimes called the Black Crocodile)
              New Guinea Crocodile, Crocodylus novaeguineae
              Mugger Crocodile, Marsh Crocodile, or Indian Crocodile, Crocodylus palustris
              Saltwater Crocodile or Estuarine Crocodile, Crocodylus porosus
              Cuban Crocodile, Crocodylus rhombifer
              Siamese Crocodile, Crocodylus siamensis
    - **Subfamily Tomistominae** (recent studies may show that this group is actually more closely related to the Gavialidae)
        - Genus Kentisuchus (extinct)

Genus Gavialosuchus (extinct)
Genus Paratomistoma (extinct)
Genus Thecachampsa (extinct)
Genus Kentisuchus (extinct)
Genus Rhamphosuchus (extinct)

- Genus *Tomistoma*
    - False gharial or Malayan gharial, Tomistoma schlegelii

      Tomistoma lusitanica (extinct)

      Tomistoma cairense (extinct)

In popular culture

- In the fictional Peter Pan series by J.M Barrie, a large crocodile serves as Captain Hook's worst fear, as it bit his hand off, leaving him with his hook. It also ate a clock, and thus ticking lets Hook know if the Crocodile is approaching.

- In the Disney movie The Wild, two abandoned pet crocodiles that dwell in the sewer guide the protagonists to the harbor rather than eating them.

- In the Disney movie The Emperor's New Groove and corresponding TV shows and sequels, the villain, Yzma, has a pet crocodile that lives in a chamber that is accessed by a lever next to another lever that accesses her secret lab. Often she comically pulls the wrong lever, falling into the pit, and returns with the crocodile latched onto her, and she says 'Why do we even have that lever?'.

- The Cheburashka series of books (by Eduard Uspensky) and animated films feature Crocodile Gena as one of the main characters. He works in a zoo as a crocodile.

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Dinosaurs

Fossil range: Triassic – Cretaceous (except avian)
Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Subclass: Diapsida
Infraclass: Archosauromorpha
(unranked) Archosauria
(unranked) Ornithodira
Superorder: **Dinosauria** *, Owen, 1842
Orders & Suborders

- **Saurischia**
  - Sauropodomorpha
    Theropoda
- **Ornithischia**
  - Thyreophora
    Ornithopoda
    Marginocephalia

Dinosaurs were vertebrate animals that dominated terrestrial ecosystems for over 160 million years, first appearing approximately 230 million years ago. At the end of the Cretaceous Period, 65 million years ago, dinosaurs succumbed to a catastrophic extinction, which ended their dominance on land. Taxonomists consider modern birds to be the direct descendants of theropod dinosaurs.

Since the first dinosaur was recognized in the 19th century, mounted, fossilized dinosaur skeletons have become major attractions at museums around the world. Dinosaurs have become a part of world culture and remain consistently popular among children and adults alike. They have been featured in best-selling books and films such as Jurassic Park, and new discoveries are regularly covered by the media.

The term *dinosaur* is sometimes used informally to describe other prehistoric reptiles, such as the pelycosaur Dimetrodon, the winged pterosaurs and the aquatic ichthyosaurs, plesiosaurs and mosasaurs, although technically none of these were dinosaurs.

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What is a dinosaur?

Definition

The taxon **Dinosauria** was formally named by the English palaeontologist Richard Owen in 1842 as "a distinct tribe or suborder of Saurian reptiles".[1] The term is derived from the Greek words ´µ¹½ÌÂ (*deinos* meaning "terrible", "fearsome" or "formidable") and Ã ±ÍÁ± (*saura* meaning "lizard" or "reptile"). Owen chose it to express his awe at the size and majesty of the extinct animals, not out of fear or trepidation at their size and often-formidable arsenal of teeth and claws.

Dinosaurs were an extremely varied group of animals; according to a 2006 study, 527 dinosaur genera have been identified with certainty so far, and 1,844 genera are believed to have existed.[2][3] Some were herbivorous, others carnivorous. Some dinosaurs were bipeds, some were quadrupeds, and others, such as Ammosaurus and Iguanodon, could walk just as easily on two or four legs. Regardless of body type, nearly all known dinosaurs were well-adapted for a predominantly terrestrial, rather than aquatic or aerial, habitat.

Dinosaur synapomorphies

All dinosaurs so far discovered share certain modifications to the ancestral archosaurian skeleton. Although some later groups of dinosaurs featured further modified versions of these traits, they are considered typical across Dinosauria; the earliest dinosaurs had them and passed them on to all their descendants. Such common structures across a taxonomic group are called synapomorphies.

Dinosaur synapomorphies include: reduced fourth and fifth digits on the manus ('hand'), reduced number of digits on the pes (foot) to three main toes, a sacrum (the region of the vertebral column to which the pelvis attaches, composed of three or more fused vertebrae) and an open or perforate acetabulum (hip socket with a hole at its centre). Dinosaurs are unique among all tetrapods in having this perforate acetabulum.

Other shared anatomical features

Scientists generally agree that a variety of other anatomical features were shared by most dinosaurs. These include forelimbs shorter and lighter than hind limbs, an unusual secondary palate that permitted dinosaurs to eat and breathe simultaneously, a relatively straight femur with medially-directed femoral head, two pairs of holes in the temporal region of the skull (i.e. a diapsid skull), rearward-

pointing elbows in the front limbs and forward-pointing knees in the hind limbs.

The hip joint arrangement described above allowed an erect stance, in which hind limbs were situated directly beneath the body or 'underslung'. This stance is like that of most mammals today but unlike that of other reptiles, which have a less erect posture and limbs splayed out to either side. The vertical action of the limbs in dinosaurs allowed for more efficient and faster locomotion, compared to the clumsier and slower movement of other 'sprawled' reptiles. It also allowed many types of dinosaurs to become bipedal.

Taxonomic definition

Under phylogenetic taxonomy, dinosaurs are defined as all descendants of the most recent common ancestor of Triceratops and modern birds. They are divided into Ornithischia (bird-hipped) and Saurischia (lizard-hipped), depending upon pelvic structure. Ornithischian dinosaurs had a four-pronged pelvic configuration, incorporating a caudally-directed (rear-pointing) pubis bone with (most commonly) a forward-pointing process. By contrast, the pelvic structure of saurischian dinosaurs was three-pronged, and featured a pubis bone directed cranially, or forwards, only. Ornithischia includes all taxa sharing a more recent common ancestor with Triceratops than with Saurischia, while Saurischia includes those taxa sharing a more recent common ancestor with birds than with Ornithischia. It has also been suggested that Dinosauria be defined as all the descendants of the most recent common ancestor of Megalosaurus and Iguanodon, because these were two of the three genera cited by Richard Owen when he recognized the Dinosauria.

There is an almost universal consensus among paleontologists that birds are the descendants of theropod dinosaurs. Using the strict cladistical definition that all descendants of a single common ancestor are related, modern birds are dinosaurs and dinosaurs are, therefore, not extinct. Modern birds are classified by most paleontologists as belonging to the subgroup Maniraptora, which are coelurosaurs, which are theropods, which are saurischians, which are dinosaurs.

However, referring to birds as 'avian dinosaurs' and to all other dinosaurs as 'non-avian dinosaurs' is cumbersome. Birds are still referred to as birds, at least in popular usage and among ornithologists. It is also technically correct to refer to birds as a distinct group under the older Linnaean classification system, which accepts paraphyletic taxa that exclude some descendants of a single common ancestor. Paleontologists mostly use cladistics, which classifies birds as dinosaurs, but some biologists of the older generation do not.

For clarity, this article will use 'dinosaur' as a synonym for 'non-

avian dinosaur', and 'bird' as a synonym for 'avian dinosaur' (meaning any animal that evolved from the common ancestor of *Archaeopteryx* and modern birds). The term 'non-avian dinosaur' will be used for emphasis as needed. It should be noted that this article's definition of 'bird' differs from the definition common in everyday language; to most non-scientists, a 'bird' is simply a two-legged animal with wings and feathers.

Size

While the evidence is incomplete, it is clear that, as a group, dinosaurs were large. Even by dinosaur standards, the sauropods were gigantic. For much of the dinosaur era, the smallest sauropods were larger than anything else in their habitat, and the largest were an order of magnitude more massive than anything else that has since walked the Earth. Giant prehistoric mammals such as the Indricotherium and the Columbian mammoth were dwarfed by the giant sauropods, and only a handful of modern aquatic animals approach them in size — most notably the blue whale, which reaches up to 190,000 kg (209 tons) and 33.5 m (110 ft) in length.

Most dinosaurs, however, were much smaller than the giant sauropods. Current evidence suggests that dinosaur average size varied through the Triassic, early Jurassic, late Jurassic and Cretaceous periods.[4] According to paleontologist Bill Erickson, estimates of median dinosaur weight range from 500 kg to 5 tonnes; a recent study of 63 dinosaur genera yielded an average weight greater than 850 kg — comparable to the weight of a grizzly bear — and a median weight of nearly 2 tons, or about as much as a giraffe. This contrasts sharply with the size of modern mammals; on average, mammals weigh only 863 grams, or about as much as a large rodent. The smallest dinosaur was bigger than two-thirds of all current mammals; the majority of dinosaurs were bigger than all but 2% of living mammals.[5]

Largest and smallest dinosaurs

Only a tiny percentage of animals ever fossilize, and most of these remain buried in the earth. Few of the specimens that are recovered are complete skeletons, and impressions of skin and other soft tissues are rare. Rebuilding a complete skeleton by comparing the size and morphology of bones to those of similar, better-known species is an inexact art, and reconstructing the muscles and other organs of the living animal is, at best, a process of educated guesswork. As a result, scientists will probably never be certain of the largest and smallest dinosaurs.

The tallest and heaviest dinosaur known from a complete skeleton is the Brachiosaurus specimen that was discovered in Tanzania between 1907–12. It is now mounted and on display at the Humboldt Museum of Berlin and is 12 m (38 ft) tall and probably weighed between 30,000–60,000 kg (33–66 short tons). The longest complete dinosaur is the 27 m (89 ft) long Diplodocus, which was discovered in Wyoming in the United States and displayed in Pittsburgh's Carnegie Natural History Museum in 1907.

There were larger dinosaurs, but knowledge of them is based entirely on a small number of incomplete fossil samples. The largest herbivorous specimens on record were all discovered in the 1970s or later, and include the massive Argentinosaurus, which may have weighed 80,000–100,000 kg (88–121 tons); the longest, the 40 m (130 ft) long Supersaurus; and the tallest, the 18 m (60 ft) Sauroposeidon, which could have reached a sixth-floor window. The largest known carnivorous dinosaur was Spinosaurus, reaching a length of 16-18 meters (53-60 ft), and weighing in at 9 tons. Other large meat-eaters included Giganotosaurus, Mapusaurus, Tyrannosaurus rex and Carcharodontosaurus.

Not including modern birds like the bee hummingbird, the smallest dinosaurs known were about the size of a crow or a chicken. The theropods Microraptor, Parvicursor, and Saltopus were all under 60 cm (2 ft) in length.

Behavior

Interpretations of dinosaur behavior are generally based on the pose of body fossils and their habitat, computer simulations of their biomechanics, and comparisons with modern animals in similar ecological niches. As such, the current understanding of dinosaur behavior relies on speculation, and will likely remain controversial for the foreseeable future. However, there is general agreement that some behaviors which are common in crocodiles and birds, dinosaurs' closest living relatives, were also common among dinosaurs.

The first perceived direct evidence of herding behavior was the 1878 discovery of 31 Iguanodon dinosaurs which were thought to have perished together in Bernissart, Belgium, after they fell into a deep, flooded sinkhole and drowned.[6] Despite the deposition of those skeletons being now regarded as more gradual,[7] other, well supported, mass death sites were subsequently discovered. Those, along with multiple trackways, suggest that herd or pack behavior was common in many dinosaur species. Trackways of hundreds or even thousands of herbivores indicate that duck-bills (hadrosaurids) may

have moved in great herds, like the American Bison or the African Springbok. Sauropod tracks document that these animals traveled in groups composed of several different species, at least in Oxford, England,[8] and others kept their young in the middle of the herd for defense according to trackways at Davenport Ranch, Texas. Dinosaurs may have congregated in herds for defense, for migratory purposes, or to provide protection for their young.

Jack Horner's 1978 discovery of a Maiasaura ("good mother dinosaur") nesting ground in Montana demonstrated that parental care continued long after birth among the ornithopods.[9][10] There is also evidence that other Cretaceous-era dinosaurs, like the Patagonian sauropod Saltasaurus (1997 discovery), had similar nesting behaviors, and that the animals congregated in huge nesting colonies like those of penguins. The Mongolian maniraptoran Oviraptor was discovered in a chicken-like brooding position in 1993, which may mean it was covered with an insulating layer of feathers that kept the eggs warm. [11] Trackways have also confirmed parental behavior among sauropods and ornithopods from the Isle of Skye in northwestern Scotland.[12] Nests and eggs have been found for most major groups of dinosaurs, and it appears likely that dinosaurs communicated with their young, in a manner similar to modern birds and crocodiles.

The crests and frills of some dinosaurs, like the marginocephalians, theropods and lambeosaurines, may have been too fragile to be used for active defense, so they were likely used for sexual or aggressive displays, though little is known about dinosaur mating and territorialism. The nature of dinosaur communication also remains enigmatic, and is an active area of research. For example, recent evidence suggests that the hollow crests of the lambeosaurines may have functioned as resonance chambers used for a wide range of vocalizations.

From a behavioral standpoint, one of the most valuable dinosaur fossils was discovered in the Gobi Desert in 1971. It included a Velociraptor attacking a Protoceratops,[13] proving that dinosaurs did indeed attack and eat each other. While cannibalistic behavior among theropods is no surprise,[14] this too was confirmed by tooth marks from Madagascar in 2003.[15]

There seem to have been no burrowing species of dinosaur and few climbing species. This is somewhat surprising when compared to the later mammalian radiation in the Cenozoic, which included many species of these types. As to how the animals moved, biomechanics has provided significant insight. For example, studies of the forces exerted by muscles and gravity on dinosaurs' skeletal structure have demonstrated how fast dinosaurs could run,[16][17] whether diplodocids could create sonic booms via whip-like tail snapping,[18]

whether giant theropods had to slow down when rushing for food to avoid fatal injuries,[19] and if sauropods could float.[20]

Evolution of dinosaurs

Dinosaurs diverged from their archosaur ancestors approximately 230 million years ago during the Middle to Late Triassic period, roughly 20 million years after the Permian-Triassic extinction event wiped out an estimated 95% of all life on Earth.[21][22] Radiometric dating of fossils from the early dinosaur genus Eoraptor establishes its presence in the fossil record at this time. Paleontologists believe Eoraptor resembles the common ancestor of all dinosaurs;[23] if this is true, its traits suggest that the first dinosaurs were small, bipedal predators.[24] Such a notion is corroborated by the more primitive dinosaur-like ornithodirans hailing from Middle Triassic strata of Argentina such as Marasuchus and Lagerpeton, which were also small bipedal, perhaps leaping, predators.

The first few lines of primitive dinosaurs diversified rapidly through the rest of the Triassic period; dinosaur species quickly evolved the specialized features and range of sizes needed to exploit nearly every terrestrial ecological niche. During the period of dinosaur predominance, which encompassed the ensuing Jurassic and Cretaceous periods, nearly every known land animal larger than 1 meter in length was a dinosaur.

The Cretaceous-Tertiary extinction event, which occurred approximately 65 million years ago at the end of the Cretaceous period, caused the extinction of all dinosaurs except for the line that had already given rise to the first birds. Other diapsid species related to the dinosaurs also survived the event.

Study of dinosaurs

Knowledge about dinosaurs is derived from a variety of fossil and non-fossil records, including fossilized bones, feces, trackways, gastroliths, feathers, impressions of skin, internal organs and soft tissues.[25][26] Many fields of study contribute to our understanding of dinosaurs, including physics, chemistry, biology, and the earth sciences (of which paleontology is a sub-discipline).

Dinosaur remains have been found on every continent on Earth, including Antarctica. Numerous fossils of the same dinosaur species have been found on completely different continents, corroborating the generally-accepted theory that all land masses were at one time connected in a super-continent called Pangaea. Pangaea began to break apart during the Triassic period roughly 230 million years ago. [27]

The current "dinosaur renaissance"

The field of dinosaur research has enjoyed a surge in activity that began in the 1970s and is ongoing. This was triggered, in part, by John Ostrom's discovery of Deinonychus, an active, vicious predator that may have been warm-blooded, in marked contrast to the prevailing image of dinosaurs as sluggish and cold-blooded. Vertebrate paleontology, arguably the primary scientific discipline involved in dinosaur research, has become a global science. Major new dinosaur discoveries have been made by paleontologists working in previously unexploited regions, including India, South America, Madagascar, Antarctica, and most significantly in China (the amazingly well-preserved feathered dinosaurs in China have further consolidated the link between dinosaurs and their conjectured living descendants, modern birds). The widespread application of cladistics, which rigorously analyzes the relationships between biological organisms, has also proved tremendously useful in classifying dinosaurs. Cladistic analysis, among other modern techniques, helps to compensate for an often incomplete and fragmentary fossil record.

Classification

Dinosaurs (including birds) are archosaurs, like modern crocodilians. Archosaurs' diapsid skulls have two holes located where the jaw muscles attach, called temporal fenestrae. Most reptiles

(including birds) are diapsids; mammals, with only one temporal fenestra, are called synapsids; and turtles, with no temporal fenestra, are anapsids. Anatomically, dinosaurs share many other archosaur characteristics, including teeth that grow from sockets rather than as direct extensions of the jawbones. Within the archosaur group, dinosaurs are differentiated most noticeably by their gait. Dinosaur legs extend directly beneath the body, whereas the legs of lizards and crocodylians sprawl out to either side. All dinosaurs were land animals.

Many other types of reptiles lived at the same time as the dinosaurs. Some of these are commonly, but incorrectly, thought of as dinosaurs, including plesiosaurs (which are not closely related to the dinosaurs) and pterosaurs, which developed separately from reptilian ancestors in the late Triassic period.

Collectively, dinosaurs are usually regarded as a superorder or an unranked clade. They are divided into two orders, the Saurischia and the Ornithischia, on the basis of their hip structure. Saurischians ('lizard-hipped', from the Greek sauros (Ã±ÅÁ¿Â) meaning 'lizard' and ischion (¹ÃÇ¹¿½) meaning 'hip joint') are dinosaurs that originally retained the hip structure of their ancestors. They include all the theropods (bipedal carnivores) and sauropods (long-necked herbivores). Ornithischians ('bird-hipped', from the Greek ornitheos (¿Á½¹¸µ¹¿Â) meaning 'of a bird' and ischion (¹ÃÇ¹¿½) meaning 'hip joint') is the other dinosaurian order, most of which were quadrupedal herbivores. (**NB:** the terms "lizard hip" and "bird-hip" are misnomers — birds evolved from dinosaurs with "lizard hips".)

The following is a simplified classification of dinosaur families.

The dagger (†) is used to indicate taxa that are extinct.

Order Saurischia

- †Infraorder Herrerasauria
- Suborder Theropoda
  - †Superfamily Coelophysoidea
  - †Infraorder Ceratosauria
    - †Family Abelisauridae
  - (unranked) Tetanurae
    - †Superfamily Megalosauroidea
    - †Infraorder Carnosauria
    - Infraorder Coelurosauria
      - †Family Coeluridae
      - †Superfamily Tyrannosauroidea
      - †(unranked) Ornithomimosauria

            - (unranked) Maniraptora
                - †(unranked) Oviraptoriformes
                    - †(unranked) Therizinosauria
                    - †(unranked) Oviraptorosauria
                - †(unranked) Deinonychosauria
                    - †Family Troodontidae
                    - †Family Dromaeosauridae
                - Class Aves (birds)
- †Suborder Sauropodomorpha
    - †Thecodontosaurus
    - †Infraorder Prosauropoda
    - †Infraorder Sauropoda
        - †Superfamily Diplodocoidea
        - †Superfamily Titanosauriformes
            - †Family Brachiosauridae
            - †(unranked) Titanosauria

Order Ornithischia

- †Suborder Thyreophora
    - †Infraorder Stegosauria
    - †Infraorder Ankylosauria
- †(unranked) Cerapoda
    - †Family Heterodontosauridae
    - †Suborder Marginocephalia
        - †Infraorder Pachycephalosauria
        - †Infraorder Ceratopsia
            - †Family Psittacosauridae
            - †Family Protoceratopsidae
            - †Family Ceratopsidae
    - †Suborder Ornithopoda
        - †Family Hypsilophodontidae
        - †Infraorder Iguanodontia
            - †Family Iguanodontidae
            - †Family Hadrosauridae

Areas of debate

Warm-bloodedness

A vigorous debate on the subject of temperature regulation in dinosaurs has been ongoing since the 1960s. Originally, scientists broadly disagreed as to whether dinosaurs were capable of regulating their body temperatures at all. More recently, dinosaur endothermy has become the consensus view, and debate has focused on the mechanisms of temperature regulation.

After dinosaurs were discovered, paleontologists first posited that they were ectothermic creatures: "terrible lizards" as their name suggests. This supposed cold-bloodedness implied that dinosaurs were relatively slow, sluggish organisms, comparable to modern reptiles, which need external sources of heat in order to regulate their body temperature. Dinosaur ectothermy remained a prevalent view until Robert T. "Bob" Bakker, an early proponent of dinosaur endothermy, published an influential paper on the topic in 1968.

Modern evidence indicates that dinosaurs thrived in cooler temperate climates, and that at least some dinosaur species must have regulated their body temperature by internal biological means (perhaps aided by the animals' bulk). Evidence of endothermism in dinosaurs includes the discovery of polar dinosaurs in Australia and Antarctica (where they would have experienced a cold, dark six-month winter), the discovery of dinosaurs whose feathers may have provided regulatory insulation, and analysis of blood-vessel structures that are typical of endotherms within dinosaur bone. Skeletal structures suggest that theropods and other dinosaurs had active lifestyles better suited to an endothermic cardiovascular system, while sauropods exhibit fewer endothermic characteristics. It is certainly possible that some dinosaurs were endothermic while others were not. Scientific debate over the specifics continues.[28]

Complicating the debate is the fact that warm-bloodedness can emerge based on more than one mechanism. Most discussions of dinosaur endothermy tend to compare them to average birds or mammals, which expend energy to elevate body temperature above that of the environment. Small birds and mammals also possess insulation, such as fat, fur, or feathers, which slows down heat loss. However, large mammals, such as elephants, face a different problem because of their relatively small ratio of surface area to volume (Haldane's principle). This ratio compares the volume of an animal

with the area of its skin: as an animal gets bigger, its surface area increases more slowly than its volume. At a certain point, the amount of heat radiated away through the skin drops below the amount of heat produced inside the body, forcing animals to use additional methods to avoid overheating. In the case of elephants, they are hairless, and have large ears which increase their surface area, and have behavioral adaptations as well (such as using the trunk to spray water on themselves and mud wallowing). These behaviors increase cooling through evaporation.

Large dinosaurs would presumably have had to deal with similar issues; their body size suggest they lost heat relatively slowly to the surrounding air, and so could have been what are called inertial homeotherms, animals that are warmer than their environments through sheer size rather than through special adaptations like those of birds or mammals. However, so far this theory fails to account for the vast number of dog- and goat-sized dinosaur species which made up the bulk of the ecosystem during the Mesozoic period.

Feathered dinosaurs and the bird connection

Birds and non-avian dinosaurs share many features. Birds share over a hundred distinct anatomical features with theropod dinosaurs, which are generally accepted to have been their closest ancient relatives.[29]

Feathers

Archaeopteryx, the first good example of a "feathered dinosaur", was discovered in 1861. The initial specimen was found in the Solnhofen limestone in southern Germany, which is a lagerstätte, a rare and remarkable geological formation known for its superbly detailed fossils. Archaeopteryx is a transitional fossil, with features clearly intermediate between those of modern reptiles and birds. Brought to light just two years after Darwin's seminal The Origin of Species, its discovery spurred the nascent debate between proponents of evolutionary biology and creationism. This early bird is so dinosaur-like that, without a clear impression of feathers in the surrounding rock, specimens are commonly mistaken for Compsognathus.

Since the 1990s, a number of additional feathered dinosaurs have been found, providing even stronger evidence of the close relationship between dinosaurs and modern birds. Most of these specimens were unearthed in the Liaoning province in northeastern China, which was part of an island continent during the Cretaceous period. Though feathers have been found only in the lagerstätte of the Yixian

Formation and a few other places, it is possible that non-avian dinosaurs elsewhere in the world were also feathered. The lack of widespread fossil evidence for feathered non-avian dinosaurs may be due to the fact that delicate features like skin and feathers are not often preserved by fossilization and thus are absent from the fossil record.

The feathered dinosaurs discovered so far include Beipiaosaurus, Caudipteryx, Dilong, Microraptor, Protarchaeopteryx, Shuvuuia, Sinornithosaurus, Sinosauropteryx, and Jinfengopteryx. Dinosaur-like birds like Confuciusornis, which are anatomically closer to modern avians, have also been discovered. All of these specimens come from the same formation in northern China. The dromaeosauridae family in particular seems to have been heavily feathered, and at least one dromaeosaurid, Cryptovolans, may have been capable of flight.

Skeleton

Because feathers are often associated with birds, feathered dinosaurs are often touted as the missing link between birds and dinosaurs. However, the multiple skeletal features also shared by the two groups represent the more important link for paleontologists. Furthermore, it is increasingly clear that the relationship between birds and dinosaurs, and the evolution of flight, are more complex topics than previously realized. For example, while it was once believed that birds evolved from dinosaurs in one linear progression, some scientists, most notably Gregory S. Paul, conclude that dinosaurs such as the dromaeosaurs may have evolved from birds, losing the power of flight while keeping their feathers in a manner similar to the modern ostrich and other ratites.

Comparison of bird and dinosaur skeletons, as well as cladistic analysis, strengthens the case for the link, particularly for a branch of theropods called maniraptors. Skeletal similarities include the neck, pubis, wrist (semi-lunate carpal), arm and pectoral girdle, shoulder blade, clavicle and breast bone.

Reproductive biology

A discovery of features in a Tyrannosaurus rex skeleton recently provided even more evidence that dinosaurs and birds evolved from a common ancestor and, for the first time, allowed paleontologists to establish the sex of a dinosaur. When laying eggs, female birds grow a special type of bone in their limbs. This medullary bone, which is rich in calcium, forms a layer inside the hard outer bone that is used to make eggshells. The presence of endosteally-derived bone tissues lining the interior marrow cavities of portions of the Tyrannosaurus rex specimen's hind limb suggested that *T. rex* used similar reproductive strategies, and revealed the specimen to be female.

A dinosaur embryo was found without teeth, suggesting that some

parental care was required to feed the young dinosaur. It is also possible that the adult dinosaurs regurgitated into a young dinosaur's mouth to provide sustenance, a behavior that is also characteristic of numerous modern bird species.

Lungs

Large meat-eating dinosaurs had a complex system of air sacs similar to those found in modern birds, according to an investigation which was led by Patrick O'Connor of Ohio University. The lungs of theropod dinosaurs (carnivores that walked on two legs and had birdlike feet) likely pumped air into hollow sacs in their skeletons, as is the case in birds. "What was once formally considered unique to birds was present in some form in the ancestors of birds", O'Connor said. The study was funded in part by the National Science Foundation.[30]

Heart and sleeping posture

Modern computerized tomography (CT) scans of dinosaur chest cavities (conducted in 2000) found the apparent remnants of complex four-chambered hearts, much like those found in today's mammals and birds. A recently discovered troodont fossil demonstrates that the dinosaurs slept like certain modern birds, with their heads tucked under their arms.[31] This behavior, which may have helped to keep the head warm, is also characteristic of modern birds.

Gizzard

Another piece of evidence that birds and dinosaurs are closely related is the use of gizzard stones. These stones are swallowed by animals to aid digestion and break down food and hard fibres once they enter the stomach. When found in association with fossils, gizzard stones are called gastroliths. Because a particular stone could have been swallowed at one location before being carried to another during migration, paleontologists sometimes use the stones found in dinosaur stomachs to establish possible migration routes.

Evidence for Cenozoic dinosaurs

In 2002, paleontologists Zielinski and Budahn reported the discovery of a single hadrosaur leg bone fossil in the San Juan Basin, New Mexico. The formation in which the bone was discovered has been dated to the early Paleocene epoch approximately 64.5 million years ago. If the bone was not re-deposited into that stratum by weathering action, it would provide evidence that some dinosaur populations may have survived at least a half million years into the Cenozoic Era.[32]

Bringing dinosaurs back to life

There has been much speculation about the use of technology to bring dinosaurs back to life. In Michael Crichton's book Jurassic Park (later adapted into a movie), which popularized the idea, scientists use blood from fossilized mosquitos that have been suspended in tree sap since the Mesozoic to reconstruct the DNA of dinosaurs, filling chromosomal gaps with modern frog genes. It is probably impossible to resurrect dinosaurs in this manner. One problem with the amber extraction method is that DNA decays over time by exposure to air, water and radiation, making it unlikely that such an approach would recover any useful DNA (DNA decay can be measured by a racemization test).

The successful extraction of ancient DNA from dinosaur fossils has been reported on two separate occasions, but upon further inspection and peer review, neither of these reports could be confirmed.[33] However, a functional visual peptide of a (theoretical) dinosaur has been inferred using analytical phylogenetic reconstruction methods on gene sequences of still-living related species (reptiles and birds).[34]

Even if dinosaur DNA could be reconstructed, it would be exceedingly difficult to "grow" dinosaurs using current technology since no closely related species exist to provide zygotes or a suitable environment for embryonic development.

Soft tissue in dinosaur fossils

One of the best examples of soft tissue impressions in a fossil dinosaur was discovered in Petraroia, Italy. The discovery was reported in 1998, and described the specimen of a small, very young coelurosaur, Scipionyx *samniticus*. The fossil includes portions of the intestines, colon, liver, muscles, and windpipe of this immature dinosaur.[25]

In the March 2005 issue of Science, Dr. Mary Higby Schweitzer and her team announced the discovery of flexible material resembling actual soft tissue inside a 68-million-year-old Tyrannosaurus rex leg bone from the Hell Creek Formation in Montana. After recovery, the tissue was rehydrated by the science team.

When the fossilized bone was treated over several weeks to remove mineral content from the fossilized bone marrow cavity (a process called demineralization), Schweitzer found evidence of intact structures such as blood vessels, bone matrix, and connective tissue (bone fibers). Scrutiny under the microscope further revealed that the

putative dinosaur soft tissue had retained fine structures (microstructures) even at the cellular level. The exact nature and composition of this material are not yet clear, although many news reports immediately linked it with the movie Jurassic Park. Interpretation of the artifact is ongoing, and the relative importance of Dr. Schweitzer's discovery is not yet clear.[35]

Extinction theories

The sudden mass extinction of the non-avian dinosaurs, around 65 million years ago, is one of the most intriguing mysteries in paleontology. Many other groups of animals also became extinct at this time, including ammonites (nautilus-like mollusks), mosasaurs, plesiosaurs, pterosaurs, herbivorous turtles and crocodiles, most birds, and many groups of mammals.[36] The nature of the event that caused this mass extinction has been extensively studied since the 1970s. At present, several related theories are broadly supported by paleontologists.

Asteroid collision

The asteroid collision theory, which was first proposed by Walter Alvarez in the late 1970s, links the extinction event at the end of the Cretaceous period to a bolide impact approximately 65.5 million years ago. Alvarez proposed that a sudden increase in iridium levels, recorded around the world in the period's rock stratum, was direct evidence of the impact. The bulk of the evidence now suggests that a 5-15 km wide bolide hit in the vicinity of the Yucatán Peninsula, creating the 170 km-wide Chicxulub Crater and triggering the mass extinction. Scientists are not certain whether dinosaurs were thriving or declining before the impact event. Some scientists propose that the meteorite caused a long and unnatural drop in Earth's atmospheric temperature, while others claim that it would have instead created an unusual heat wave.

Although the speed of extinction cannot be deduced from the fossil record alone, various models suggest that the extinction was extremely rapid. The consensus among scientists who support this theory is that the impact caused extinctions both directly (by heat from the meteorite impact) and also indirectly (via a worldwide cooling brought about when matter ejected from the impact crater reflected thermal radiation from the sun).

Multiple collisions—the Oort cloud

While similar to Alvarez's impact theory (which involved a single asteroid or comet), this theory proposes that a stream of comets was dislodged from the Oort cloud due to the gravitational disruption

caused by a passing star. One or more of these objects then collided with the Earth at approximately the same time, causing the worldwide extinction. As with the impact of a single asteroid, the end result of this comet bombardment would have been a sudden drop in global temperatures, followed by a protracted cool period.[37]

Environment changes

At the peak of the dinosaur era, there were no polar ice caps, and sea levels are estimated to have been from 100 to 250 metres (330 to 820 feet) higher than they are today. The planet's temperature was also much more uniform, with only 25 degrees Celsius separating average polar temperatures from those at the equator. On average, atmospheric temperatures were also much warmer; the poles, for example, were 50 °C warmer than today.[38][39]

The atmosphere's composition during the dinosaur era was vastly different as well. Carbon dioxide levels were up to 12 times higher than today's levels, and oxygen formed 32 to 35% of the atmosphere, as compared to 21% today. However, by the late Cretaceous, the environment was changing dramatically. Volcanic activity was decreasing, which led to a cooling trend as levels of atmospheric carbon dioxide dropped. Oxygen levels in the atmosphere also started to fluctuate and would ultimately fall considerably. Some scientists hypothesize that climate change, combined with lower oxygen levels, might have led directly to the demise of many species. If the dinosaurs had respiratory systems similar to those commonly found in modern birds, it may have been particularly difficult for them to cope with reduced respiratory efficiency, given the enormous oxygen demands of their very large bodies.[36]

History of discovery

Dinosaur fossils have been known for millennia, although their true nature was not recognized. The Chinese, whose own word for dinosaur is *konglong* (P, or "terrible dragon"), considered them to be dragon bones and documented them as such. For example, Hua Yang Guo Zhi, a book written by Zhang Qu during the Western Jin Dynasty, reported the discovery of dragon bones at Wucheng in Sichuan Province.[40] In Europe, dinosaur fossils were generally believed to be the remains of giants and other creatures killed by the Great Flood.

Megalosaurus was the first dinosaur to be formally described, in 1677, when part of a bone was recovered from a limestone quarry at Cornwell near Oxford, England. This bone fragment was identified correctly as the lower extremity of the femur of an animal larger than anything living in modern times. The second dinosaur species to be identified, Iguanodon, was discovered in 1822 by the English geologist Gideon Mantell, who recognized similarities between his fossils and the bones of modern iguanas. Two years later, the Rev William Buckland, a professor of geology at Oxford University, unearthed more fossilized bones of Megalosaurus and became the first person to describe dinosaurs in a scientific journal.

The study of these "great fossil lizards" soon became of great interest to European and American scientists, and in 1842 the English paleontologist Richard Owen coined the term "dinosaur". He recognized that the remains that had been found so far, Iguanodon, Megalosaurus and Hylaeosaurus, shared a number of distinctive features, and so decided to present them as a distinct taxonomic group. With the backing of Prince Albert of Saxe-Coburg-Gotha, the husband of Queen Victoria, Owen established the Natural History Museum in South Kensington, London, to display the national collection of dinosaur fossils and other biological and geological exhibits.

In 1858, the first known American dinosaur was discovered, in marl pits in the small town of Haddonfield, New Jersey (although fossils had been found before, their nature had not been correctly discerned). The creature was named Hadrosaurus foulkii, after the town and the discoverer, William Parker Foulke. It was an extremely important find; Hadrosaurus was the first nearly complete dinosaur skeleton found and it was clearly a bipedal creature. This was a revolutionary discovery as, until that point, most scientists had believed dinosaurs walked on four feet, like other lizards. Foulke's discoveries sparked a wave of dinosaur mania in the United States.

Dinosaur mania was exemplified by the fierce rivalry between

Edward Drinker Cope and Othniel Charles Marsh, both of whom raced to be the first to find new dinosaurs in what came to be known as the Bone Wars. The feud probably originated when Marsh publicly pointed out that Cope's reconstruction of an Elasmosaurus skeleton was flawed; Cope had inadvertently placed the plesiosaur's head at what should have been the animal's tail end. The fight between the two scientists lasted for over 30 years, ending in 1897 when Cope died after spending his entire fortune on the dinosaur hunt. Marsh won the contest primarily because he was better funded through a relationship with the US Geological Survey. Unfortunately, many valuable dinosaur specimens were damaged or destroyed due to the pair's rough methods; for example, their diggers often used dynamite to unearth bones (a method modern paleontologists would find appalling). Despite the pair's unrefined methods, their contributions to paleontology were vast; Marsh unearthed 86 new species of dinosaur and Cope discovered 56, for a total of 142 new species. Cope's collection is now at the American Museum of Natural History in New York, while Marsh's is on display at the Peabody Museum of Natural History at Yale University.[41]

Since 1897, the search for dinosaur fossils has extended to every continent, including Antarctica. The first Antarctic dinosaur to be discovered, the ankylosaurid Antarctopelta oliveroi, was found on Ross Island in 1986, although it was 1994 before an Antarctic species, the theropod Cryolophosaurus ellioti, was formally named and described in a scientific journal.

Current dinosaur "hot spots" include southern South America (especially Argentina) and China. China in particular has produced many exceptional feathered dinosaur specimens due to the unique geology of its dinosaur beds, as well as an ancient arid climate particularly conducive to fossilization.

In popular culture

By human standards, dinosaurs were creatures of fantastic appearance and often enormous size. As such, they have captured people's imagination and become an enduring part of human popular culture. Dinosaur exhibitions, parks and museum exhibits around the world both cater to and reinforce the public's interest. The popular preoccupation with dinosaurs is also reflected in a broad array of fictional and non-fictional works.

Notable examples of older fictional works featuring dinosaurs include Arthur Conan Doyle's book The Lost World; the 1933 film King Kong; and Godzilla.

Religious views

Various religious groups have views about dinosaurs that differ from those held by scientists. While many mainstream scientists respect these views as faith positions, they argue that religiously-inspired interpretations of dinosaurs do not withstand serious scientific scrutiny. See the referenced article for specific examples and further context.

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Phytosaurs

Phytosauria

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Infraclass: Archosauromorpha
(unranked) Crurotarsi
Order: **Phytosauria,** von Meyer, 1861
Family: **Phytosauridae,** Jaeger, 1828
Genera

- *?Centemodon*
  Paleorhinus
  Angistorhinus
  Brachysuchus
  Smilosuchus
  Leptosuchus
  Rutiodon
- **Pseudopalatinae**
  - *Nicrosaurus*
    ?Belodon
    Pseudopalatus
    Redondasaurus
    Angistorhinopsis
    Mystriosuchus

Phytosaurs - family **Phytosauridae** or **Parasuchidae** - were a group of large (2 to 12 meters long - average size 3 to 4 meters) semi-aquatic predatory archosaurs that flourished during the Late Triassic period. These long snouted and heavily armoured archosaurs bore a remarkable resemblance to modern crocodiles in size, appearance, and (clearly) lifestyle, an example of convergence or parallel evolution. The name "phytosaur" (plant reptile) is very misleading, and their snapping jaws clearly show that phytosaurs were predators.

Phytosaurs were actually crocodile cousins, as both phytosaurs and proto-crocodiles share a common ancestor among the early Crurotarsi. But familiar-looking crocodiles only appeared in the late Jurassic period, many millions of years after phytosaurs became extinct at the end of the Triassic.

These animals were widely distributed, fossils being recovered from Europe, North America, India, Morocco, Thailand, and

Madagascar.

Contents

Early Discoveries

When the first phytosaur fossils were found, it was not immediately obvious what kind of animal/species they were. The first phytosaur species known to science was named *Phytosaurus cylindricodon* - "plant lizard with cylindrical teeth" - by G. Jaeger in 1828 because he mistakenly believed that petrified mud fillings in the jaw were herbivore teeth. The specimen is too poor to be diagnostic, and this species name is no longer valid. The name of the group - Phytosauria - was coined by the German paleontologist Hermann von Meyer in 1861, on the basis of this first species.

The next species to be described *Belodon plieningeri* von Meyer, in von Meyer and Plieningeri 1844. The altogether more appropriate name Parasuchia ("alongside the crocodiles, as they resembled crocodiles to a great degree) was coined by Thomas Huxley in 1875 along with his discovery and naming of the Indian species Parasuchus hislopi (Chatterjee, 1978), on the basis of a partial snout. The specimen also is usually considered non-diagnostic, and the name Parasuchus replaced by Paleorhinus. Although the names Parasuchidae and Phytosauridae are variously still used by different specialists, "phytosaur" is the standard generic name for these animals, despite the fact that these animals have been clearly shown to be carnivorous.

Differences from Crocodiles

Despite their great similarities in appearance and lifestyle, there are still a number of minor differences that distinguish phytosaurs from true crocodiles. For one thing, the phytosaur ankle structure is much more primitive than that of any crocodile. Also, phytosaurs lack the bony secondary palate that crocodiles have that enables them to breathe even when the mouth is full of water. It is possible however that phytosaurs had a fleshy palate, as many Mesozoic crocodiles are presumed to have had. Finally, and most noticeably, phytosaurs had nostrils placed near or above the level of the eyes, in contrast to crocodiles where the nostrils are near the end of the snout. This adaptation may have developed to allow them to breathe while the rest of the body was submerged.

Three Morphotypes

The phytosaur skull was characterized by three distinct morphotypes, which relate to feeding and habits and not (as was once thought) evolutionary relationships. These skull patterns are linked to characteristics of the dentition; specifically the differentiation or similarity of the teeth along the jaws.

Dolichorostral ("long snouted") types have a long, slender snout and a large number of conical teeth that are the same throughout. These were most likely piscivorous, able to capture fast slippery prey, but not so good at tackling a land animal. Some examples are Paleorhinus, Rutiodon carolinensis, and Mystriosuchus. At one time it was believed that Paleorhinus and Mystriosuchus belonged to a distinct group of phytosaurs (subfamily of family Mystriosuchinae/Mystriosuchidae Huene, 1915) characterised by this adaptation, but it is now known that Mystriosuchus is actually more closely related to Pseudopalatus, an "altirostral" form (Hungerbühler, 2002).

Brachyrostral ("short snouted") forms are the opposite, they have a massive, broad snout, and a very strong skull and jaws, with the front teeth like fangs for holding the prey, and the rear teeth blade-like for slicing the meat into chunks that can easily be swallowed (an animal with different types of teeth like this is called heterodont). These were powerful animals specialised for feeding on strong struggling prey, such as terrestrial animals that come to the water to drink. Examples of this type are Nicrosaurus and Smilosuchus

Altirostral ("high snouted") animals are intermediate between the two. They had heterodont dentition but not as extremely developed as the brachyrostral type. *Angistorhinus* and *Pseudopalatus* are typical examples here. These were most likely generalist feeders.

Modern crocodiles exhibit a similar morphological diversity, for example the broad snouted altirostral alligator and the long snouted dolichorostral gavial.

Phytosaurs were even better armoured than crocodiles, protected by heavy bony scutes (often found as fossils), and the belly reinforced with a dense arrangement of gastralia (abdominal ribs).

Evolutionary History and Relationships

Phytosaurs first appear during the Carnian age, evolving from an unspecified crurotarsan ancestor. There are no clear intermediate forms, as the first phytosaurs were already fully-formed and highly specialised.

The earliest phytosaurs belong to the primitive and unspecialised but very widely distributed genus *Paleorhinus*. A somewhat more advanced and larger form, *Angistorhinus* appears at the same time or soon after. Later in the Carnian, both these animals were replaced by more specialised forms like Rutiodon, Leptosuchus, and the huge Smilosuchus (Lucas 1998). The Carnian-Norian extinction meant that these animals died off, and the Early Norian sees new genera like Nicrosaurus and Pseudopalatus, both of which belong to the most derived clade of phytosaurs, the Pseudopalatinae. Later in the middle Norian the advanced and specialised fish-eater Mystriosuchus appears. Fossil remains of this widespread animal is known from Germany, northern Italy, and Thailand. Finally the large Redondasaurus in south-west North America and the long-snouted (altirostral) Angistorhinopsis ruetimeyeri in Europe continued the group into the Rhaetian. Phytosaur footprints (the ichnotaxon Apatopus) are also known from the latest Rhaetian of the East Coast of USA (the Newark Supergroup) (Olsen et al. 2002). This indicates that phytosaurs continued as successful animals until the very end of the Triassic, when, along with other large crurotarsan archosaurs, they were killed off by the end Triassic extinction event. It was to be some fifty million years or so before any similar reptiles would appear (early true crocodiles of the early and middle Jurassic were either small and fully terrestrial or completely marine).

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Pterosaurs

Conservation status: Fossil

Fossil range: Triassic – Cretaceous

Kingdom: Animalia
Phylum: Chordata
(unranked) Archosauria
Class: Sauropsida
Order: **Pterosauria,** Kaup, 1834

Suborders

Rhamphorhynchoidea
Pterodactyloidea

Pterosaurs (/Èt[.rYÌsTÐ(r)/, from the Greek "ÀÄµÁÌÃ±ÅÁ¿Â", meaning *winged lizards*, often referred to as *pterodactyls*, from the Greek "ÀÄµÁ¿´¬ºÄÅ»¿Â", meaning "winged finger" /Ìt[.rYÈdæk.tjl/) were flying reptiles of the clade **Pterosauria**. They existed from the late Triassic to the end of the Cretaceous Period (228 to 65 million years ago). Pterosaurs were the first vertebrates to evolve flight. Their wings were formed by a sophisticated membrane of skin stretching from the thorax to a dramatically lengthened fourth finger. Earlier species had long, fully-toothed jaws and long tails, while later forms had a highly reduced tail, and some lacked teeth.

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Fossil evidence

Pterosaurs were first discovered in 1784 by the Italian naturalist Cosimo Collini. He initially believed that pterosaurs were aquatic animals, not flyers. In the 19th century Georges Cuvier proposed that pterosaurs flew.

At least 60 genera of pterosaurs have been found, ranging from the size of a small bird to wingspans in excess of 10 meters (33 feet). Since the first pterosaur fossil was discovered in the late Jurassic Solnhofen limestone in 1784, twenty-nine kinds of pterosaurs have been found in those deposits alone. Most paleontologists now believe that pterosaurs were adapted for active flight, not just gliding as was earlier believed.

Most pterosaur fossils did not preserve well. Their bones were hollow and, when sediments piled on top of them, the bones were flattened. The best preserved fossils have come from the Araripe Plateau, Brazil. For some reason, when the bones were deposited, the sediments encapsulated the bones, rather than crushing them. This created three-dimensional fossils for paleontologists to study. The first find in the Araripe Plateau was made in 1974.

The three dimensionally preserved skull of *Anhanguera santanae*, from the Santana Formation, Brazil.

Anatomy

Pterosaurs were highly modified from their reptilian ancestors for the demands of flight.

Pterosaur wings were formed by membranes of skin and other tissues, strengthened by various types of closely spaced fibers. The membranes attached to the extremely long fourth finger of each arm and extending along the sides of the body. A novel bone called the pteroid connected to the wrist and helped to support a membrane (the propatagium) between the wrist and shoulder. The pteroid might have been able to swing forward to extend this membrane, although this is very controversial. In later pterosaurs, the backbone over the shoulders fused into a structure known as a notarium, which served to stiffen the torso during flight, and provide a stable support for the scapula (shoulder blade).

Pterosaur's hip sockets were oriented facing slightly upwards, and the head of the femur (thigh bone) was only moderately inward facing, suggesting that pterosaurs had a semi-erect stance. It would have been possible to lift the thigh into a horizontal position during flight.

There has been considerable argument among paleontologists about whether the wings attached to the hindlimbs as well. Fossils of the rhamphorhynchoid Sordes, the anurognathid Jeholopterus, and a pterodactyloid from the Santana formation demonstrate that the wing membrane did attach to the hindlimbs, at least in some species. However, modern bats and flying squirrels show considerable variation in the extent of their wing membranes and it is possible that, like these groups, different species of pterosaur had different wing designs. Many if not all pterosaurs also had webbed feet, and although these have been considered to be evidence of swimming, webbed feet are also seen in some gliding animals such as colugos (the "flying lemurs"), and may have had an aerodynamic function.

Pterosaur bones were hollow and air filled, like the bones of birds. Unlike typical reptiles, pterosaurs had a keeled breastbone that was developed for the attachment of flight muscles and a brain that was more developed than comparable dinosaurs of similar sizes.

Hair

There is no fossil evidence of feathers, but pterosaurs were unique among reptiles in that at least some of them were covered with hair, similar but not homologous to mammalian hair. Pterosaur hair is not true hair; it is a form of extremely thin fiberous "scales". Although in some cases fibers in the wing membrane have been mistaken for hair, some fossils such as those of Sordes pilosus (the "hairy demon") do show the unmistakable imprints of hair on the head and body, not unlike modern-day bats, an interesting example of convergent evolution. The presence of hair (and the demands of flight) imply that pterosaurs were warm-blooded ('endothermic').

Ground movement

There has been considerable debate in the past about whether pterosaurs moved about on the ground as quadrupeds or as bipeds. A large number of pterosaur trackways are now known, with a distinctive four-toed hind foot and three-toed front foot; these are the unmistakable prints of pterosaurs walking on all fours. However, it might be too much to conclude that all pterosaurs were quadrupedal, all the time.

It has been suggested that smaller pterosaurs with longer hindlimbs such as Dimorphodon might have walked or even run bipedally, in addition to flying, not unlike modern road runners. Other small pterosaurs such as Rhamphorhynchus may have scurried around on all fours. Larger pterosaurs with proportionately smaller hindlimbs and massive forebodies are generally thought to have moved about on all fours while on the ground.

Behavior

A pterosaur egg has been found in the quarries of Liaoning, the same place that yielded the famous 'feathered' dinosaurs. The egg was squashed flat with no signs of cracking, so evidently the eggs had leathery shells. The wing membranes were unusally well developed for a hatchling in an egg, suggesting pterosaurs were ready to fly soon after birth, though whether a parent took care of them is unknown. Very young animals have been found in the Solnhofen limestone beds, where they presumably flew to the middle of a lagoon, fell in and drowned.

A study of pterosaur brains using X-rays has revealed extraordinary information about their habits. Studying fossil pterosaur skulls is extremely difficult because they are so delicate, but Lawrence Witmer at Ohio University in Athens and his colleagues used X-ray CT scans to build up 3D images of the brains of two species. One striking finding was that the animals (*Rhamphorhynchus muensteri* and Anhanguera santanae) had massive flocculi. The flocculus is a brain region that integrates signals from joints, muscles, skin and the balance organs.

The pterosaurs' flocculi occupied 7.5 % of the animals' total brain mass, more than in any other vertebrate. Birds have unusually large flocculi compared with other animals, but these only occupy between 1 and 2 % of total brain mass. "It is just ridiculously large in pterosaurs," says Witmer.

The flocculus sends out neural signals that produce small, automatic movements in the eye muscles. These keep the image on an animal's retina steady. Pterosaurs probably had such a large flocculus because of their large wing size. This extra area meant that there was a great deal more sensory information to process.

Pterosaurs are known to have been attacked by spinosaurs. In the 1 July 2004 edition of Nature, paleontologist Eric Buffetaut discusses an early Cretaceous fossil of three cervical vertebrae of a pterosaur with the broken tooth of a spinosaur embedded in it. The vertebrae are known not to have been eaten and exposed to digestion, as the joints still articulated.

Evolution and extinction

Because pterosaur anatomy has been so heavily modified for flight, and *immediate* "missing link" predecessors have not so far been described, the ancestry of pterosaurs is not well understood. They are generally, but not universally, thought to be related to the Dinosauria on the basis of their ankle structure.

They are thought to have evolved flight from some manner other than the 'tree-down' route possibly taken by birds, because pterosaurs demonstrated no adaptations useful for tree living. Most scenarios have pterosaurs evolving from long-legged, ground-running ancestors like Scleromochlus or Sharovipteryx (a less likely scenario), both of which had webs of skin from long hind legs to their bodies or tails. This suggests a 'ground-up' evolution of flight or even a route that evolved by gliding from cliff-tops.

It is believed by some that competition with early bird species may have resulted in the extinction of many of the pterosaurs. By the end of the Cretaceous, only large species of pterosaurs survived. The smaller species were extinct, and replaced by birds. At the end of the Cretaceous period, the great extinction which wiped out all dinosaurs, and many other animals, seemed to also take the pterosaurs. Others suggest that most pterosaurs were specialised for an ocean-going lifestyle. Consequently, when the K-T mass-extinction severely affected marine life that most pterosaurs fed on, they went extinct. A lack of small pterosaurs in the fossil record could be explained by competition with birds or poor preservation due to the fragility of their skeletons.

A recent dissertation by Momchil Atanassov describes two new specimens from the Late Triassic Dockum Formation of Texas that may reveal a lot of new information about the origins of pterosaurs. They still have yet to be formally described.

Taxonomy

Classification of pterosaurs has traditionally been difficult, because there were many gaps in the fossil record. Many new discoveries are now filling in these gaps and giving us a better picture of the evolution of pterosaurs. Traditionally, they are organized into two suborders:

- Rhamphorhynchoidea (Plieninger, 1901): The early, or basal pterosaurs, and had long tails and short wing metacarpals. They were small, and their fingers were still adapted to climbing. They appeared in the late Triassic period, and lasted until the late Jurassic.

- Pterodactyloidea (Plieninger, 1901): The more derived pterosaurs, with short tails and long wing metacarpals. They appeared in the middle Jurassic period, and lasted until the Cretaceous-Tertiary extinction event wiped them out at the end of the Cretaceous.

However, the Rhamphorhynchoidea are a paraphyletic group, so with the increasing use of cladistics it has fallen out of favor.

- **ORDER PTEROSAURIA** (Extinct)
    - Family Dimorphodontidae
      Family Anurognathidae
      Family Campylognathoididae
      Family Rhamphorhynchidae
    - **Suborder Pterodactyloidea**
        - **Superfamily Ornithocheiroidea**
            - Family Ornithodesmidae
              Family Ornithocheiridae
              Family Pteranodontidae
              Family Nyctosauridae
        - **Superfamily Ctenochasmatoidae**
            - Family Pterodactylidae
              Family Ctenochasmatidae
        - **Superfamily Dsungaripteroidea**
            - Family Germanodactylidae
              Family Dsungaripteridae
        - **Superfamily Azhdarchoidea**
            - Family Tapejaridae
              Family Azhdarchidae
              Family Tupuxuaridae

Well-known genera

Examples of pterosaur genera include:

- *Dsungaripterus* had a wingspan of 3 metres (10 feet), an unusual bony crest running along its snout, and long, narrow, curved jaws with a pointed tip. It lived during the early Cretaceous period.
- *Pteranodon* was 1.8 metres (six feet) long, with a wingspan of 7.5 m (25 feet), and lived during the late Cretaceous period.
- *Pterodactylus* had a wingspan of 50 to 75 centimeters (20 to 30

inches), and lived during the late Jurassic on lake shores.

- *Pterodaustro* was a Cretaceous pterosaur from South America with a wingspan around 1.33 metres and with over 500 tall, narrow teeth, which were presumably used in filter-feeding, much like modern flamingos. Also like flamingos, this pterosaur's diet may have resulted in the animal having a pink hue. It was South America's first pterosaur find.
- *Quetzalcoatlus* had a wingspan of 12 metres (40 feet) but weighed only 50 kilograms (110 pounds), and lived during the late Cretaceous period.
- *Rhamphorhynchus* was a Jurassic pterosaur with a vane at the end of its tail, which may have acted to stabilise the tail in flight.

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Pterodactyl

Pterodactyl

Pterodactyl (derived from the Greek words *ÀÄµÁÅ¶(ptero)* (wing) and *´±ºÄÅ»¿Â(dactyl)* (finger) meaning "winged finger", "wing-finger" or "finger-wing") is a common term for some types of pterosaurs or ("wing lizards"), especially the later (mainly late Jurassic or Cretaceous Periods) shorter-tailed examples, which belong to the Suborder Pterodactyloidea. The wing was a leathery skin covering, over the forelimb. Many specimens preserve a coat of fur. Well-known examples of pterodactyls are Pterodactylus, Dsungaripterus, Pteranodon and Quetzalcoatlus. Prehistoric flying reptiles of this type are sometimes referred to as dinosaurs, but this is incorrect. The term dinosaur is more correctly restricted to a certain group of terrestrial reptiles with a unique upright stance, and therefore excludes the pterosaurs and the various groups of extinct aquatic reptiles, such as ichthyosaurs, plesiosaurs, and mosasaurs. Pelycosaurs, such as the sail-backed Dimetrodon, are also commonly confused with dinosaurs, but are actually more closely related to mammals.

Another subgroup of pterosaurs, more primitive than the pterodactyloids, is the Suborder Rhamphorhynchoidea, which are mainly found in earlier (Triassic-Jurassic) deposits and usually have long tails. Examples include Dimorphodon, Eudimorphodon, Scaphognathus, Anurognathus, Sordes and Campylognathus.

Fossilised pterosaurs have been found in North America, United Kingdom, Europe, Africa and Australia. The first pterosaur fossil was found by an Italian naturalist, Collini, in 1784. The name "Pterodactyle" was first coined by Georges Cuvier in 1809 for a specimen recovered in Germany; however, due to the standardization of scientific names, the official name for this species became Pterodactylus, though the name "pterodactyl" continued to be popularly applied to all members of this first specimen's order.

A famous UK find was an example of Dimorphodon by Mary Anning, at Lyme Regis in 1828.

A dusty hoax

It was reported in an article in *The Illustrated London News* (February 9, 1856, page 166) that, in 1856, workmen laboring in a tunnel for a railway line, between Saint-Dizier and Nancy, in France, were cutting through Jurassic limestone when a large creature stumbled out from inside it. It fluttered its wings, made a croaking noise and dropped dead. According to the workers, the creature had a 10 foot wingspan, four legs joined by a membrane, black leathery skin, talons for feet and a toothed mouth. A local student of paleontology identified the animal as a pterodactyl. The report had the animal turn to dust, as soon as it had died.

Supported by the lack of evidence, this story is believed to have been a hoax, stimulated in part by contemporary Franco-Prussian palaeontological rivalry. The Solnhofen limestone from Bavaria (in which Archaeopteryx would later be discovered) was producing many prized fossils, each of which was proudly announced by German paleontologists. The tunnel in question was through limestone of similar age to the Solnhofen Limestone, so it presented an opportunity for a graphic rival French story.

Pterodactyls in popular culture

A number of creatures in popular culture are called pterodactyls. Often, these creatures are in fact pteranodons.

- French comic book artist Jean 'Moebius' Giraud has featured pterodactyl-like creatures which appear to be made of concrete in several of his works, including Arzach and The Incal.
- The pterodactyl is the power source of the Pink Ranger in the television series Mighty Morphin Power Rangers. (The animal was actually a pteranodon, but it was thought that children might be confused with "Mastodon" and "Pteranodon" right after each other in the morphing order, so the pterodactyl was chosen instead; in the show it derived from, Kyouryuu Sentai ZyuRanger, the creature was indeed a pteranodon.) Another pterodactyl, known as the Pterazord, is used by the Yellow Ranger in Power Rangers: Dino Thunder.
- Petrie in The Land Before Time films is called by most a pterodactyl, and so is Pterri on Pee Wee's Playhouse .
- The Dinobot Swoop from The Transformers is often called a pterodactyl, however he most resembled a pteranodon when transformed.
- In the Mac OS X game Nanosaur 2, the player takes the form of a Pterodactyl.
- At MIT, the pterodactyl is the unofficial mascot of chemical engineering students. The mascot is named the "Course X Pterodactyl" (referring to the department number (ten) of the chemical engineering department).
- The horror film *Pterodactyl*.
- The band Pterodactyl.
- Though only referred to as "gwangi", the dinosaurs in Steve Berman's short story "Secrets of the Gwangi" that hunt a pair of gay cowboys are pterodactyls.
- Torchwood, a Doctor Who spin-off, features one as a pet.
- In the arcade classic *Joust* the invincable Pterodactyl swoops in and dismounts you if you do not complete the level quickly.

Archosauriformes

Fossil range: Late Permian - Recent

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Subclass: Diapsida
Infraclass: Archosauromorpha
(unranked) Archosauriformes, Gauthier, 1986
Groups
Proterosuchidae
Erythrosuchidae
Euparkeriidae
Archosauria

Archosauriformes (Greek for 'ruling lizards', and 'form') are a clade of diapsid reptiles that developed from Archosauromorph ancestors some time in the Late Permian (roughly 250 million years ago). These reptiles, which include members of the family Proterosuchidae and more advanced forms, were superficially crocodile-like predatory semi-aquatic animals about 1.5 meters long, with a sprawling elbows-out stance and long snouts. Unlike the bulk of their therapsid contemporaries, the Proterosuchids happily survived the catastrophe at the end of the Permian, perhaps because they were opportunistic scavengers, perhaps because they could retreat into water to find respite from an overheated climate. Any such scenarios are hypothetical; what is clearer is that these animals were highly successful in their new environment, and evolved quickly. Within a few millions years at the opening of the Triassic, the Proterosuchids had given rise to the Erythrosuchidae (the first sauropsids to totally dominate their environment), who in turn were the ancestors of the small agile Euparkeriidae, from whom a number of successfully more advanced families - the Archosaurs proper - evolved rapidly to fill empty ecological niches in the devastated global system.

Pre-*Euparkeria* Archosauriformes were in the past included in the suborder Proterosuchia of the order Thecodontia. Under the cladistic methodology, the Proterosuchia are rejected as a paraphyletic assemblage, and the pre-Archosaurian taxa are simply considered as basal Archosauriformes.

Taxonomy

- **Class Sauropsida**
  - **Infraclass Archosauromorpha**
    - **(unranked) ARCHOSAURIFORMES**
      - Family Proterosuchidae
        - Archosaurus
          Chasmatosuchus
          Kalisuchus
          Proterosuchus
          Tasmaniosaurus
      - Family Erythrosuchidae
        - Fugusuchus
          Garjainia
          Erythrosuchus
          Shanshisuchus
          Vjushkovia
      - Family Euparkeriidae
        - *Euparkeria*
      - **(unranked) Avesuchia**
        - *Yonghesuchus*
        - Family Proterochampsidae
          - Tropidosuchus
            Cerritosaurus
            Chanaresuchus
            Gualosuchus
            Proterochampsa
        - **(unranked) Archosauria**

Archosauromorpha

Fossil range: Middle Permian - Recent

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Subclass: Diapsida
Infraclass: **Archosauromorpha,** von Huene, 1946
Orders: See text

Archosauromorpha (Greek for "ruling lizard forms") is an Infraclass of diapsid reptiles that first appeared during the late Permian and became more common during the Triassic. Included in this infraclass are the orders Rhynchosauria, Trilophosauridae, Prolacertiformes, Archosauriformes, and, tentatively, the Choristodera. While superficially these reptiles vary in appearance (at one time they were even included in different subclasses-- the Trilophosaurs were considered Euryapsids, and the Rhynchosaurs were considered lepidosaurs and were included in the same order as the tuatara), they are actually united by a number of small skeletal and skull-related details that suggest they form a clade that descended from a single common ancestor.

Of the five taxa mentioned above, the first three died out at or prior to the end Triassic extinction. The Choristoderans continued as a minor group until the Miocene, and the Archosauriformes were important factors in early Triassic environments before giving rise to the even more successful Archosauria.

Classification

Subclass Diapsida

- **Infraclass ARCHOSAUROMORPHA**
  - **Order Prolacertiformes**
  - ?*Longisquama*
  - **Order Rhynchosauria**
  - **Order Trilophosauria**
  - **?Order Choristodera**
  - **Archosauriformes**
    - Family Proterosuchidae
      Family Erythrosuchidae
      Family Euparkeriidae
      Family Proterochampsidae
    - **Archosauria**
      - **Crurotarsi**
        - **Order Crocodilia** (crocodiles)
      - **Ornithodira**
        - **?Order Pterosauria**
        - **Superorder Dinosauria**

Prolacertiformes

Fossil range: Permian-Triassic

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Subclass: Diapsida
Infraclass: Archosauromorpha
Order: **Prolacertiformes,** Camp, 1945
Families
Protorosauridae
Prolacertidae
Sharovipterygidae

Prolacertiformes (sometimes called **Protorosaurs**) were an order of archosauromorph reptiles that lived during the Permian and Triassic Periods. Many species seem to have been adapted for an arboreal lifestyle, including the "delta-winged glider" Sharovipteryx, while others, such as Tanystropheus, had extremely long, stiffened necks (possibly used to catch fish), and may have been at least partly aquatic.

Other enigmatic reptile groups have sometimes been assigned by some resarches to the Prolacertiformes, including the drepanosaurids, Longisquama, and the Pterosaurs. Senter (2004) re-assigned the bizarre, arboreal drepanosaurids and Longisquama to a group of more primitive diapsids called Avicephala, though some researchers still place these forms among the prolacertiformes.

Classification

Infraclass Archosauromorpha

- **Order PROLACERTIFORMES**
  - **Family Protorosauridae**
    - *Protorosaurus*
  - **Family Prolacertidae**
    - Kadimakara
      Pamelaria
      Prolacerta
  - Jesairosaurus
    Malerisaurus
    Macrocnemus
    Langobardisaurus
    Boreopricea
    Cosesaurus
  - **Family Sharovipterygidae**
    - *Sharovipteryx*
  - ?**Order Pterosauria**
  - **Family Tanystrophidae**
    - Tanytrachelos
      Tanystropheus

References

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Avicephalans

Fossil range: Permian-Triassic

Kingdom: Animalia

Phylum: Chordata

Class: Sauropsida

Subclass: Diapsida

(unranked) **Avicephala,** Senter, 2004

Families

Longisquamidae

Coelurosauravidae

Drepanosauridae

Avicephala is an extinct order of bizarre diapsid reptiles that lived during the Late Permian and Triassic periods. Many species had odd specialized grasping limbs and prehensile tails, adapted to arboreal (and possibly aquatic) lifestyles.

Contents

Anatomy and Lifestyle

The name "avicephala" means "bird heads", in reference to the distinctive triangular skulls of these reptiles that mimic the shape of bird skulls. A few avicephalans, such as Hypuronector, even appear to have had pointed, toothless, bird-like beaks. This cranial similarity to birds has led a few scientists to theorize that birds descended from avicephalans like Longisquama, though a majority see the similarity simply as convergence. This similarity may also have led to the possible misidentification of the would-be "first bird", Protoavis (Renesto, 2000).

Avicephalans possessed a variety of odd and distinctive characteristics in addition to their bird-like skulls. Some displayed unique dermal appendages, such as the feather-like dorsal plumes of *Longisquama*, and the laterally-oriented rib-like rods of *Coelurosauravus*, which supported membranes and may have been used to glide from branch to branch in an arboreal habitat.

Another avicephalan group, the drepanosaurids, featured a suite of bizarre, almost chameleon-like skeletal features. Above the shoulders of most species was a specialized "hump" formed from fusion of the vertebrae, possibly used for advanced muscle attachments to the neck, and allowing for quick forward-striking movement of the head (perhaps to catch insects). Many had derived hands with two fingers opposed to the remaining three, an adaptation for grasping branches. Some individuals of Megalancosaurus (possibly exclusive to either males or females) had a primate-like opposable toe on each foot, perhaps used by one sex for extra grip during mating. Most species had broad, prehensile tails, sometimes tipped with a large "claw", again to aid in climbing. These tails, tall and flat like those of newts and crocodiles, have led some researches to conclude that they were aquatic rather than arboreal. Senter (2004) dismisses this idea, while Colbert and Olsen (2001), in their description of Hypuronector, state that while other drepanosaurs were probably arboreal, Hypuronector was uniquely adapted to aquatic life. The tail of this genus was extremely deep and non-prehensile – much more fin-like than other drepanosaurs.

Taxonomy

Taxonomic history

The various avicephalan groups have been difficult to pin down in terms of their phylogenetic position. Some of these enigmatic reptiles, specifically the drepanosaurids and Longisquama, have been assigned by some resarches to the prolacertiformes (Renesto 1994). Senter (2004), however, found them to form a group with the coelurosauravids, for which he coined the name Avicephala, as a sister taxon to Neodiapsida (the group which includes all modern diapsids and their extinct relatives).

Within Avicephala, Senter created the group Simiosauria ("monkey lizards") for the extremely derived tree-dwelling forms. Senter found that *Hypuronector*, originally described as a drepanosaurid, actually lies just outside that family, along with the primitive drepanosaur *Vallesaurus*. He also recovered a close relationship between the drepanosaurs *Dolabrosaurus* and *Megalancosaurus*.

Classification

Class Sauropsida

- **Subclass Diapsida**
  - **Family Longisquamidae**
    - *Longisquama*
  - **Family Coelurosauravidae**
    - Weigeltisaurus
      Coelurosauravus
  - **Family Drepanosauridae**
    - Vallesaurus
      Hypuronector
      Drepanosaurus
      Dolabrosaurus
      Megalancosaurus

Phylogeny

Cladogram after Senter, 2004.

```
Avicephala |?- Longisquama |--Coelurosauravidae | |--Weigeltisaurus | `--Coelurosauravus `-- Simiosauria |--Vallesaurus `--+--Hypuronector `-- Drepanosauridae |?-Unnamed sp. (GR 1113) (Harris & Downs, 2002) |--Drepanosaurus `--+--Dolabrosaurus `--Megalancosaurus
```

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Fictional reptiles

Fictional dinosaurs | Fictional turtles

Fictional dinosaurs

Contents

Literature

- The dinosaurs from the book series Dinotopia
  Michael Crichton's Jurassic Park series.

Film

- 26, a baby Chasmosaurus in Dinotopia series
  Aladar and most other characters in Dinosaur
  Godzilla
  Half the characters in We're Back: A Dinosaur's Story
  Littlefoot and most other characters in The Land Before Time
  Tasha, extrasmart dinosaur in Land of the Lost series (1991)
  Theodore Rex, a genetically modified Tyrannosaurus rex in Theodore Rex
  Zippo, a neurotic Stenonychosaurus in Dinotopia series
  Rhedosaurus the dinosaur from the Ray Haryhausen classic The Beast from 20,000 Fathoms
  Yonggary from the movie 'Reptilian'

Animation, cartoon and puppetry

- Barney, Baby Bop, and B.J. in Barney & Friends
  The mousers... Little robot dinosaurs in the Teenage Mutant Ninja Turtles
  Bob, Dawn, and Rex in Dilbert
  Dink the Little Dinosaur
  Steggy Doctari Thuggo Mr.Rex El Gordo in Thunderlizard Terrible in Eek! The Cat
  Casimir and Hippolyte in the French series L'Île aux Enfants
  Denver
  Animated Godzilla (Zilla) (Not a true dinosaur but the son of a mutated iguana)
  Dino in The Flintstones
  Gertie the Dinosaur by Winsor McCay
  "Grumpy" and many others from Land of the Lost
  Half the characters from Harry and His Bucket Full of Dinosaurs
  The characters from Dinosaurs
  Most of the characters in Dinosaucers
  Littlefoot and most other characters in The Land Before Time
  Old Lace, a genetically engineered Deinonychus from the future in Marvel's Runaways
  Rex the Green Dinosaur in Toy Story and Toy Story 2
  Rocky B from the Brach's Rocks commercials
  The three dinosaurs in Dinosaur Comics
  Tootsie The Triceratops Pet Bubba caveduck Ducktales
  T. Bone and most of his friends in the Extreme dinosaurs
  Dorothy the Dinosaur, character in The Wiggles
  Greymon, MetalGreymon, and numerous other Digimon
  Various dinosaurs, including a Tyrannosaurus and a Stegosaurus, in the "Rite of Spring" sequence of Fantasia.
  Dinosaur Transformers including Autobot Dinobots and Decepticon Trypticon.

Video games

- Yoshi, and later on, Boshi, in the Mario series.
  Birdo from the Mario series.
  Rex, Dino Rhino, and various other enemies in the Mario series.
  Blablanadon, a pterosaur in the Mario series.
  Bub and Bob in Bubble Bobble
  The Dinosaur Tribes in Star Fox Adventures
  The Lizardmen in Spider-Man
  Tirra in Bomberman/Bomberman Duel/Bomberman fantasy race
  'Trinity', the name of a man-made dromaeosaurid from the video game 'Dino Stalker'.
  Tricky the triceratops, from Diddy Kong Racing and the newer Star Fox games.
  Rexaur a gigantic tyrannosaur enemy from Final Fantasy VIII
  Many Pokémon are considered dinosaurs such as Lapras, Aerodactyl, Tyranitar, et cetera.

Fictional turtles

Turtles and tortoises are depicted in Western culture as, snapping turtles aside,[1] easygoing, patient and wise creatures. Due to their long lifespan, slow movement and wrinkled appearance, they are often implicated in myths about the origin of the Earth.

Contents

Turtles in popular culture

In comics

- The Teenage Mutant Ninja Turtles are comic-book characters whose adventures have been adapted for TV and film. They are:
  - Leonardo
    Michaelangelo
    Raphael
    Donatello
- There is a Turtle in *B.C.*
- In the anime and manga of Love Hina, a flying sea turtle named Tama-Chan is owned by the character Mutsumi Otohime.
- Son Goku from Dragon Ball uses "Turtle Style" Martial Arts, the "Kame-Hame-Ha" itself translates to Turtle Destruction Wave.Master Roshi has a pet sea turtle known as just turtle.
- There is a turtle in *Pogo* named Churchy LaFemme.
- There is a turtle in *Over the Hedge* named Verne.
- There is a book by Dr.Seuss known as "Yertle the Turtle", in which Yertle is the king of the pond of Salamasond.

In film

- Bert the Turtle is a character in Duck and Cover
  Cecil Turtle is a character in Looney Tunes
  In Japanese science fiction, a fire-breathing flying turtle named Gamera is the star of his own series of giant monster movies.
  In the 2003 Disney-Pixar film Finding Nemo there is a sea turtle character named Crush, known for his "surfer dude" philosophies. His son "Squirt" later becomes an exchange student at Nemo's school.
  In 2002, Dana Carvey dressed as a turtle and asked, "Am I not turtly enough for the turtle club?" in the film The Master of Disguise.

In literature

- Michael Ende's books Momo (1973) and The Neverending Story (1979) feature, respectively, the tortoise Cassiopeia, who can see into the future and display messages on her shell, and the giant, wise swamp turtle Morla. Some other works of his also feature turtles and tortoises.
  In the books by Terry Pratchett, the Discworld rests on the back of the gigantic star-turtle Great A'Tuin. In the Discworld novel Small Gods the Great God Om manifests as a tortoise.
  The Turtle (also known as Maturin) appears in a number of Stephen King's novels, including It, and The Dark Tower series. It is a guardian of the beam, and a nursery rhyme from Roland's world opens with "See the turtle of enormous girth, on his shell he holds the Earth".
  Esio Trot is a children's book written by Roald Dahl that centres around a man who uses an array of tortoises to help him romance the woman who lives in the flat below him. Esio Trot is tortoise spelt backwards.
  The Mock Turtle in Alice's Adventures in Wonderland by Lewis Carroll. In the illustration by John Tenniel, the Mock Turtle is shown as a turtle with the head of a calf, front legs that resemble oysters, and the back legs of a sheep, referencing the real ingredients of mock turtle soup.
  The book "Old Turtle" by Douglas Wood and illustrated by Cheng-Khee Chee features a title character that fufills the wise old turtle stereotype, giving insight about the nature of the world and the nature of God.

In video games

- The various species of Koopa including King Bowser in the Mario games are based on turtles and tortoises.
  The Squirtle, Wartortle, and Blastoise species and the Torkoal and Shuckle species from the Pokémon series are based on sea turtles and tortoises, respectively.
  In the Sly Cooper series, one of the characters is a turtle named Bentley.

In pop music

- The Mock Turtles, an indie-baggie band from the late 89's/early

90's Madchester scene, had a hit with 'Can You Dig It?'
A 1968 recording by guitarist John Fahey is called "The Voice of the Turtle". This is a reference to Song of Solomon 2:12 in an old translation which actually refers to the turtle-dove, but Fahey probably misread it deliberately because turtles were very important to him.
Syd Barret recorded a song named "Terrapin" for his album The Madcap Laughs in 1970. The song was later covered, live, by Pink Floyd guitarist David Gilmour.
In 1996, Harry Connick, Jr. released an album called "Star Turtle."
Rock singer Sting's solo debut album was entitled The Dream of the Blue Turtles.
The Turtles, Tortoise, and Beatnik Turtle are musical groups.
The Grateful Dead recorded a song entitled "Terrapin Station", which appears on the album of the same name and was a steady inclusion in their live repertoire.
The Alternative Rock band They Might Be Giants recorded the Marty Stouffer style "Turtle Songs of North America" for their first podcast. If you subscribe to their Free Tunes service it can be downloaded here.

In television

- Franklin, is the star of a Canadian children's television series
  The fencing Touché Turtle in the animated series Touché Turtle and Dum Dum
  Flying turtles show up often in the anime Love Hina including mentions of a ancient turtle civilization.
  Tooter Turtle -- Drizzle, drazzle, druzzle, drome, time for this one to come home.

Other

- The ornate box turtle is the state reptile of Kansas. It is ironic that turtles have been banned as classroom pets in Kansas and many other states in the United States.
  A possibly apocryphal story goes: Bertrand Russell, giving a lecture on astronomy, described how the earth orbits the sun which orbits and the movement of the sun about the galaxy.

When he had finished, an old lady stood up and protested: "What you have told us is rubbish. The world is really a flat plate supported on the back of a giant turtle." Russell smiled and asked gently, "What is the turtle standing on?" "You're very clever, young man, very clever," said the woman. "But it's turtles all the way down."

The mascot of the University of Maryland, College Park is the diamondback terrapin, which is also the state reptile of Maryland.

The mascot of the Ptolemaic Terrascope magazine is a turtle named Ptolemy.

the mascot of the KAME project is that of a sea turtle.

Tortoise species in fiction

British author Patrick O'Brian created a fictional tortoise, Testudo aubreii, for his book HMS Surprise. In the book, naturalist and intelligence officer Stephen Maturin discovers the tortoise and names it in honor of his friend, Captain Jack Aubrey.

Religion, fables and mythology

- One avatar of Vishnu is said to be the giant turtle Kurma.
  In Hinduism, Akupara is a tortoise who carries the world on his back. It upholds the earth and the sea.
  The myth of Theseus features a giant man-eating turtle, to which a villain would feed humans by pushing the victims off a cliff and into the turtle's ocean.
  In Chinese mythology, the tortoise represents longevity due to its prolonged life-span. It is one of the four most prominent beasts of China and is of the water element. In Feng Shui the rear of the home is represented by the symbolic animal the Black Tortoise, signifying support for home, family life and personal relationships. If you don’t have a building or structure representing the Black Tortoise behind your home you can place a symbolic tortoise there for enhanced support to this aspect of life. A tortoise at the back door or in the backyard by a pond is said to attract good fortune and many blessings. Three tortoises stacked on top of each other represents a mother and her babies.
  In Aesop's fable The Tortoise and the Hare, a tortoise defeats an overconfident hare in a race.

Notes

1. ‘ Snapping turtles in fiction can be rather villainous; an example would be Tokka in the film *Teenage Mutant Ninja Turtles II: The Secret of the Ooze.*

Lepidosaurs

Lepidosaurians

Fossil range: Late Triassic - Recent

Kingdom: Animalia

Phylum: Chordata

Class: Sauropsida

Subclass: Diapsida

Infraclass: Lepidosauromorpha

Superorder: **Lepidosauria**

Orders

Sphenodontia

Squamata

The **Lepidosauria** are reptiles with overlapping scales. They include the tuataras, lizards, snakes and amphisbaenians. Lepidosaurians are the most successful of modern reptiles.

Lepidosauria is a superorder of Sauropsida and comprises the orders :

- Squamata - scaled reptiles (lizards, snakes and amphisbaenians)
- Sphenodontia or Rhynchocephalia - tuatara
-

Sauropterygia | Squamata | Lepidosauromorpha

Sauropterygia

Sauropterygians
Fossil range: Late Permian - Late Cretaceous
Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Superorder: **Sauropterygia,** Owen, 1860
Orders
?Thalattosauriformes
Placodontia
Nothosauroidea
Plesiosauria

Sauropterygia ("lizard flippers") is a group of very successful aquatic reptiles that flourished during the Age of the Dinosaurs before they became extinct. They are united by a radical adaptation of their shoulder, designed to support powerful flipper strokes. Some later sauropterygians like the pliosaurs developed a similar mechanism in their pelvis.

The earliest sauropterygians appeared about 245 million years ago (Ma), at the start of the Triassic period. Early examples were small (around 60 cm), semi-aquatic lizard-like animals with long limbs (pachypleurosaurs), but they quickly grew to be several meters long and spread into shallow waters (nothosaurs). The Triassic-Jurassic extinction event wiped them all out except for the plesiosaurs. During the Early Jurassic these diversified quickly into both long-necked small-headed plesiosaurs proper, and short-necked large-headed pliosaurs. Originally it was thought that Plesiosaurs and Pliosaurs were two distinct superfamilies that followed separate evolutionary paths. It now seems that these were simply morphotypes in that both types evolved a number of times, with some pliosaurs evolving from plesiosaur ancestors, and vice-versa.

Each morphotype filled a specific ecological role. The large pliosaurs, like the Jurassic Rhomaleosaurus, Liopleurodon and Pliosaurus, and the Cretaceous Kronosaurus and Brachauchenius, were the superpredators of the Mesozoic seas, around 7 to 12 meters in length, and filled a similar ecological role to that of killer whales today. The long-necked plesiosaurs, meanwhile, included both those with medium-long necks, like the 3 to 5 meter-long Plesiosauridae and the Cryptoclididae, and the Jurassic and Cretaceous Elasmosauridae, which evolved progressively longer and more flexible necks, so that by the middle and late Cretaceous the entire animal was over 13 meters in length (e.g. Elasmosaurus), although as most of this was the neck,

the actual body size was much smaller than that of the larger pliosaurs. These long-necked forms undoubtedly fed on fish, which they probably snared in their tooth-lined jaws with rapid lunges of the neck and head.

Disregarding reports of lake monsters like the Loch Ness Monster, they all perished 65 Mya during the Cretaceous-Tertiary extinction event.

Classification is difficult because the demands of the aquatic environment caused the same characteristics to evolve multiple times, illustrating convergent evolution. While sauropterygians are considered diapsids, they are also sometimes classified with turtles. The bulky-bodied, mollusc-eating placodonts may also be sauropterygians. In addition to the modifications of the shoulder, the group is also united by several modifications in their skulls.

Taxonomy

- **Class Sauropsida** (reptiles)
  - **Infraclass Lepidosauromorpha** (lizards and relatives)
    - **SUPERORDER SAUROPTERYGIA**
      - Order Thalattosauriformes
        - Suborder Thalattosauria
      - Order Placodontia
      - (unranked) **Eusauropterygia**
        - Order Nothosauroidea
          - Suborder Pachypleurosauria
          - Suborder Nothosauria
        - (unranked) **Pistosauroidea**
          - Corosaurus
            Chinchenia
            Kwangsisaurus
            Cymatosaurus
            Family Pistosauridae
          - Order Plesiosauria
            - Suborder Plesiosauroidea (long-necked plesiosaurs)
              Suborder Pliosauroidea (short-necked plesiosaurs)

Nothosaur | Pachypleurosaur | Placodont | Plesiosaur | Plesiosauria | Plesiosaurus | Pliosaur

Nothosaur

Fossil range: Triassic
Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Superorder: Sauropterygia
Order: **Nothosauria,** Baur, 1889
Suborders

- **Suborder Pachypleurosauria**
  - Pachypleurosauridae
- **Suborder Nothosauria**
  - Simosauridae
    Germanosauridae
    Nothosauridae

Nothosaurs (order *Nothosauria*) were Triassic marine sauropterygian reptiles that may have lived like seals of today, catching food in water but coming ashore on rocks and beaches. They averaged about three meters in length, with a long body and tail. The feet had become paddle-like, and were most certainly webbed in life, to help power the animal when swimming. The neck was quite long, and the head was elongate and flattened, and relatively small in relation to the body. The margins of the long jaws were equipped with numerous sharp outward-pointing teeth, indicating a diet of fish.

The nothosaurs consist of two suborders--the Pachypleurosaurs, tiny, primitive forms, and the true **Nothosaurs**, which evolved from pachypleurosaurs. Nothosaur-like reptiles were in turn ancestral to the more completely marine plesiosaurs, which replaced them at the end of the Triassic period.

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Pachypleurosaur

Fossil range: Triassic
Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Superorder: Sauropterygia
Order: Nothosauroidea
Suborder: **Pachypleurosauria,** Nopcsa, 1928
Family: **Pachypleurosauridae,** Nopcsa, 1928

Genera

Anarosaurus
Dactylosaurus
Hanosaurus
Keichousaurus
Neusticosaurus
Serpianosaurus

Pachypleurosaurs were primitive Triassic sauropterygian reptiles that vaguely resembled aquatic lizards, and are limited to the Triassic period. They were elongate animals, ranging in size from 20 cm to about a meter in length, with small heads, long necks, paddle-like limbs, and long deep tails. The limb girdles are greatly reduced, so it is unlikely these animals could move about on land. The widely spaced peg-like teeth project at the front of the jaws, and indicate that these animals fed on fish.

Pachypleurosaurs were originally and are often still included among the Nothosaurs (Carroll 1988, Benton 2004). In some cladistic classifications however (Rieppel 2000), they are considered the sister group to the Eusauropterygia, the clade that includes the nothosaurs and plesiosaurs.

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Placodont

Fossil range: Triassic
Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Superorder: Sauropterygia
Order: **Placodontia,** Cope, 1871
Families
Paraplacodontidae
Placodontidae
Henodontidae
Cyamodontidae
Placochelyidae

Placodonts were a group of marine reptiles that lived during the Triassic period, becoming extinct at the end of the period. It is believed that they were related to the Sauropterygia, the group that includes Plesiosaurs. Placodonts were generally between one to two metres in length, with some of the largest measuring three metres long.

In appearance, they resembled some of today's large bottom-feeding mammals such as walruses or dugongs, others looking more turtle-like due to large bony plates on their backs. They had short limbs and were highly robust.

Because of their dense bone and heavy armour plating, these creatures would have been too heavy to float in the ocean and would have used a lot of energy to reach the water surface. For this reason and because of the type of sediment found accompanying fossils it is suggested they lived in shallow waters and not in deep oceans.

Their diet consisted of marine bivalves, brachiopods, and other invertebrates. They were notable for their large, flat, often protruding teeth which they used to crush molluscs and brachiopods, which they hunted on the sea bed (another way in which they were similar to walruses). The Palate teeth were extremely thick and large enough to crush thick shell.

The first specimen was discovered in 1830, and they have since been discovered throughout Europe and the Middle East.

Classification

- **Class Sauropsida**
  - **Superorder Sauropterygia**
    - **ORDER PLACODONTIA**
      - Genus *Saurosphargis*
      - Family Paraplacodontidae
        - Genus *Paraplacodus*
      - Family Placodontidae
        - Genus *Placodus*
      - **Superfamily Cyamodontoidea**
        - Family Henodontidae
          - Genus *Henodus*
        - Family Cyamodontidae
          - Genus *Cyamodus*
        - Genus *Protenodontosaurus*
        - Family Placochelyidae
          - Genus *Placochelys*
          - Genus *Psephoderma*

Plesiosaur

Fossil range: Jurassic to Cretaceous
Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Superorder: Sauropterygia
Order: Plesiosauria
Suborder: **Plesiosauroidea,** Gray, 1825
Families
Cimoliasauridae
Cryptoclididae
Elasmosauridae
Plesiosauridae
Polycotylidae

Plesiosaurs (IPA /ÈplisjYÌsTy/) (Greek: ***plesios*** meaning 'near' or 'close to' and ***sauros*** meaning 'lizard') were carnivorous aquatic (mostly marine) reptiles. After their discovery, they were somewhat fancifully said to have resembled "a snake threaded through the shell of a turtle". The common name 'plesiosaur' is applied both to the 'true' plesiosaurs (Suborder Plesiosauroidea) and to the larger taxonomic rank of Plesiosauria, which includes both long-necked (elasmosaurs) and short-necked (polycotylid) forms. Short-necked, large-headed plesiosaurs are more properly called pliosaurs. There were many species of plesiosaurs and not all of them were as large as *Liopleurodon*, *Kronosaurus* or *Elasmosaurus*.

Plesiosaurs (*sensu* Plesiosauroidea) first appeared at the very start of the Jurassic Period and thrived until the K-T extinction, at the end of the Cretaceous Period. While they were Mesozoic reptiles that lived at the same time as dinosaurs, they were not dinosaurs.

The first plesiosaur skeletons were found in England by Mary Anning, in the early 1800s. A virtually complete plesiosaur skeleton was found in 2002, in the cliffs at Filey, Yorkshire, England, by an amateur palaeontologist. The preserved skeleton will be displayed at Scarborough's new Rotunda Museum, from 2007.

It is occasionally claimed that plesiosaurs are not extinct, although the evidence for this belief is generally not accepted in the scientific world. The modern 'sightings' that are occasionally reported are usually explained either as basking shark carcasses or as hoaxes.

Contents

Description

Typical plesiosaurs had a broad body and a short tail. They retained their ancestral two pairs of limbs, which evolved into large flippers. Plesiosaurs evolved from earlier, similar forms such as pistosaurs or very early, longer-necked pliosaurs. There are a number of families of plesiosaurs, which retain the same general appearance and are distinguished by various specific details. These include the Plesiosauridae, unspecialised types which are limited to the Early Jurassic period; Cryptoclididae, (e.g. Cryptoclidus), with a medium-long neck and somewhat stocky build; Elasmosauridae, with very long, inflexible necks and tiny heads; and the Cimoliasauridae, a poorly known group of small Cretaceous forms. According to traditional classifications, all plesiosaurs have a small head and long neck but, in recent classifications, one short-necked and large-headed Cretaceous group, the Polycotylidae, are included under the Plesiosauroidea, rather than under the traditional Pliosauroidea.

Behaviour

Unlike their Pliosaurian cousins, Plesiosaurs (with the exception of the Polycotylidae) were probably relatively slow swimmers. It is likely that they cruised slowly below the surface of the water, using their long flexible neck to move their head into position to snap up unwary fish or cephalopods. Their unique, four-flippered swimming adaptation may have given them exceptional maneuverability, so that they could swiftly rotate their bodies as an aid to catching their prey.

Contrary to many reconstructions of plesiosaurs, it would have been impossible for them to lift their head and long neck above the surface, in the 'swan-like' pose that is often shown. Even if they had been able to bend their necks upward, to that degree (they could not), gravity would have tipped their body forward and kept most of the heavy neck in the water.

Taxonomy

The classification of plesiosaurs has varied over time; the following represents one current version (see O'Keefe 2001)

- **Superorder SAUROPTERYGIA**
  - **Order PLESIOSAURIA**
    - Suborder **Pliosauroidea**
    - Suborder **Plesiosauroidea**
      - Family Plesiosauridae
      - (Unranked) **Euplesiosauria**
        - Family Elasmosauridae
        - Superfamily Cryptoclidoidea
          - Family Cryptoclididae
          - (Unranked) Tricleidia
            - *Tricleidus*
            - Family Cimoliasauridae
            - Family Polycotylidae

In fiction

The plesiosaur is popular among children and cryptozoologists, appearing in a number of children's books and several films. It fought an icthyosaur in Jules Verne's novel Journey to the Center of the Earth. In the bizarre 1899 short story "The Monster of Lake LaMetrie" a man's brain was put into the body of a plesiosaur. It has appeared in films about lake monsters, including Magic in the Water (1995) and movies about the Loch Ness Monster, such as Loch Ness (1996). In both films, the creature primarily serves as a symbol of a lost, child-like sense of wonder. The plesiosaur is also present in the Japanese Jaws-inspired movie Legend of the Dinosaurs (1983). There are also unsubstantiated rumors across the Internet that a Plesiosaur may be featured in the upcoming film Jurassic Park IV.

Contrary to reports, the long-necked, sharp-toothed creature in the classic film King Kong (1933), which flips a raft full of rescuers on their way to save Fay Wray and then munches on the swimmers, is not a plesiosaur. Despite striking a profile in the mist, very similar to the famous 'Surgeon's Photo' of the Loch Ness Monster, it then chases the routed heroes onto dry land, where it is clearly intended to be a sauropod, like the Brontosaurus (now Apatosaurus). However, Kong later battles a serpent-like creature in a cave, which possesses four flippers and resembles a plesiosaur but acts more like some kind of giant snake. In Steve Alten's novel The Trench, a climatic scene at the end has a Megalodon fighting with several deep sea reptiles, similar to Pliosaurs, identified as Kronosaurs.

Alleged living plesiosaurs

Lake or sea monster sightings are occasionally explained as plesiosaurs. While the survival of a small, unrecorded breeding colony of plesiosaurs for the 65,000,000 years (with respect to evolution) since their apparent extinction is unlikely, the discovery of real and even more ancient living fossils such as the Coelacanth and of previously unknown but enormous deep-sea animals such as the giant squid, have fuelled imaginations.

The 1977 discovery of a carcass with flippers and what appeared to be a long neck and head, by the Japanese fishing trawler Zuiyo Maru, off New Zealand, created a plesiosaur craze in Japan. Members of a blue-ribbon panel of eminent marine scientists in Japan reviewed the discovery. Professor Yoshinori Imaizumi, of the Japanese National Science Museum, said, "It's not a fish, whale, or any other mammal." Others argued that it was actually a decayed basking shark but Professor Toshio Kasuya said: "If it were a shark, the spine would be smaller and the neck itself is too long, as shown in the picture. I think we can exclude the fish theory."

The Loch Ness Monster is reported to resemble a plesiosaur. Arguments against the plesiosaur theory include the fact that the lake is too cold for a cold-blooded animal to survive easily, that air-breathing animals like plesiosaurs would be easily spotted when they surface to breathe, that the lake is too small to support a breeding colony and that the loch itself formed only 10,000 years ago during the last ice age.

However, these arguments have all been opposed by Robert Rines, who said that "animals can adapt" and that "some reptiles can stay in water for a long time". "Many sightings tell of "horns" or "ears", which may be nostrils. If it(the monster) breathes regularly, it could breathe without being noticed".

While no definitive claims have been made about the biology of the plesiosaurs, most scientific evidence points to the fact that dinosuars (which were contemporaries and distant relatives of plesiosaurs) were warm-blooded. This should not be an indication of the thermophysiology of the plesiosaurs, however -- modern reptiles, which are also "distant relatives" of dinosaurs, are most assuredly cold-blooded.

There are some theories of how plesiosaurs may have surfaced to breathe but supporters of the notion of surviving plesiosaurs say that plesiosaurs may have lifted only their nostrils above the surface to breathe. Some artist's impressions of plesiosaurs support this.

The National Museums of Scotland confirmed that vertebrae

discovered on the shores of Loch Ness, in 2003, belong to a plesiosaur, although there are some questions about whether the fossils were planted (BBC News, July 16, 2003).

It was reported in The Star (Malaysia) on April 8th, 2006, that fishermen discovered bones resembling that of a Plesiosaur near Sabah, Malaysia. The creature was speculated to have died only a month before. A team of researchers from Universiti Malaysia Sabah investigated the specimen but the bones were later determined to be those of a whale.

On November 2nd, 2006, Leslie Noè of the Sedgwick Museum in Cambridge, UK, announced research which casts further doubt on a plesiosaur inhabiting Loch Ness. While many sightings of the monster include reports of it lifting it's head out of the water, including the Spurling photo, Noè's study of fossilized vertebrae of a Muraenosaurus concluded this articulation would not be possible. Instead, he found that the neck evolved to point downwards allowing the plesiosaur to feed on soft-shelled animals living on the sea floor. [3]

However, there is no evidence that the monster is of that exact species and over time the neck muscles could have become stronger. Additionally, the monster is sometimes seen as only humps and the neck isn't always seen.

Trivia

- The Transformers character Magmatron turns into a *Plesiosaur*.
- Plesiosaurus is one of the prehistoric creatures mentioned in Jules Verne's "Journey to the Center of the Earth", in which it fights an Ichthyosaur in the Central Sea.
- Where was the first elasmosaur found?

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See also Mike Everhart's "Marine Reptile References" and scans of "Early papers on North American plesiosaurs" on the Oceans of Kansas Paleontology website.

Plesiosauria

Fossil range: Triassic to Cretaceous
Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Superorder: Sauropterygia
Order: **Plesiosauria,** de Blainville, 1835
Suborders
Plesiosauroidea
Pliosauroidea

Plesiosauria (IPA /ÈplisiYÌsTy/) (Greek: *plesios* meaning 'near to' and *sauros* meaning 'lizard') are an order of Mesozoic marine reptiles. They first appeared in the middle Triassic Period and became especially common during the Jurassic Period, thriving until the K-T extinction at the end of the Cretaceous Period.

The name "plesiosaur" is variously used to refer both to the Order Plesiosauria as a whole, and to the long-necked forms (Suborder Plesiosauroidea) only. These latter constitute the plesiosaurs in the popular imagination ("Nessie"). In the current page, "Plesiosaur" is used to refer to the Plesiosauria in general.

Contents

Description

The typical plesiosaur had a broad body and a short tail. They retained their ancestral two pairs of limbs, which evolved into large flippers. Plesiosaurs evolved from the earlier nothosaurs, who had a more crocodile-like body; major types of plesiosaur are primarily distinguished by head and neck size. The Plesiosauroidea such as Cryptoclididae, Elasmosauridae and Plesiosauridae had long necks and may have been 'bottom-feeders', in shallow waters. The Pliosauridae (Pliosaurs), however, had a short neck with large, elongated head and may have been at home in deeper waters.

All plesiosaurs had four paddle-shaped 'flipper' limbs. This is an unusual arrangement in aquatic animals and it is thought that they were used to propel the animal through the water by a combination of rowing movements and up-and-down movements. There appears to have been no tail fin and the tail was most likely used for helping in directional control. This arrangement is in contrast to that of the later mosasaurs and the earlier ichthyosaurs. There may be similarities with the method of swimming used by penguins and turtles, which respectively have two and four flipper-like limbs.

As a group, the plesiosaurs were the largest aquatic animals of their time, and even the smallest were about 2 m (6.5 ft) long. They grew to be considerably larger than the largest giant crocodiles, and were bigger than their successors, the mosasaurs. However, their predecessors as rulers of the sea, the dolphin-like ichthyosaurs, are known to have reached 23 m in length, and the modern whale shark (18 m), sperm whale (20 m), and especially the blue whale (30 m) are known from considerably larger specimens.

The anteriorly placed internal nostrils have palatal grooves to channel water, the flow of which would be maintained by hydrodynamic pressure over the posteriorly placed external nares during locomotion. During its passage through the nasal ducts, the water would have been 'tasted' by olfactory epithelia.

History of discovery

Mary Anning (1799 - 1847) was famous for her Plesiosaur discoveries at Lyme Regis in Dorset, UK. She is credited with the first Plesiosaur find (Plesiosaurus dolichodeirus), which has become the 'type fossil' (genoholotype). This region of Britain is now a World Heritage Site, dubbed the Jurassic Coast.

Behaviour

Plesiosaurs have been discovered with fossils of belemnites (squid-like animals), and ammonites (giant nautilus-like molluscs) associated with their stomachs. They had powerful jaws, probably strong enough to bite through the hard shells of their prey. The bony fish (Osteichthyes), started to spread in the Jurassic, and were likely prey as well. Recent evidence seems to indicate that some plesiosaurs may have, in fact, been bottom feeders.

It had been theorized that smaller plesiosaurs may have crawled up on a beach to lay their eggs, like the modern leatherback turtle, but it is now clear plesiosaurs gave birth to live young.

Another curiosity is their four-flippered design. No modern animals have this swimming adaptation, so there is considerable speculation about what kind of stroke they used. While the short-necked pliosaurs (e.g. Liopleurodon) may have been fast swimmers, the long-necked varieties were built more for maneuverability than for speed. Skeletons have also been discovered with gastroliths in their stomachs, though whether to help break down food in a muscular gizzard, or to help with buoyancy has not been established (Everhart).

Taxonomy

The classification of the Plesiosauria has varied over time; the following represents one current version (mostly following O'Keefe 2001)

- **Superorder SAUROPTERYGIA**
  - **Order PLESIOSAURIA**
    - Suborder **Pliosauroidea**
      - Thalassiodracon
        Attenborosaurus
        Eurycleidus
        Family Rhomaleosauridae
        Family Pliosauridae
    - Suborder **Plesiosauroidea**
      - Family Plesiosauridae
      - (Unranked) **Euplesiosauria**
        - Family Elasmosauridae
        - Superfamily Cryptoclidoidea
          - Family Cryptoclididae
          - (Unranked) Tricleidia
            - *Tricleidus*
            - Family Cimoliasauridae
            - Family Polycotylidae (= "Dolichorhynchopidae")

Recent discoveries

In 2002, the "Monster of Aramberri" was announced to the press. Discovered in 1982 at the village of Aramberri, in the Mexican state of Nuevo León, it was originally classified as a dinosaur. The specimen is actually a very large plesiosaur, possibly reaching 15 m (50 ft) in length. The media published exaggerated reports claiming it was 25 m (80 ft) long, and weighed up to 150,000 kg, which would have made it the largest predator of all time. This error was dramatically perpetuated in BBC's documentary series Walking with Dinosaurs, which also prematurely classified it as a Liopleurodon *ferox*.

In 2004, what appears to be a completely intact juvenile plesiosaur was discovered, by a local fisherman at Bridgwater Bay National Nature Reserve in Somerset, UK. The fossil, dated 180 My by the ammonites associated with it, measures 1.5 m (5 ft) in length, and may be related to Rhomaleosaurus. It is probably the best preserved specimen of a plesiosaur yet discovered (see Ref.)

See also

- Plesiosaur

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Plesiosaurus

Fossil range: Early Jurassic
Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Superorder: Sauropterygia
Order: Plesiosauria
Suborder: Plesiosauroidea
Family: **Plesiosauridae,** Gray, 1825
Genus: ***Plesiosaurus,*** Conybeare, 1821

Species

P. dolichodirus
P. guilelmiimperatoris
? *P. brachypterygius* (jr. synon.?)
? *P. tournemirensis* (jr. synon.?)

Plesiosaurus (Greek: *plesios*, near to + *sauros*, lizard) was a large (about 3 to 5 meters long), marine Sauropterygian reptile that lived during the early part of the Jurassic period, and is known by nearly complete skeletons from the Lias of England and Germany. It was distinguished by its small head, long and slender neck, broad turtle like body, a short tail, and two pairs of large, elongated paddles. It lends its name to a larger group of reptiles as a whole Plesiosauria, of which it is an early but fairly typical member.

Contents

Discovery

Plesiosaurus was one of the first of the "antediluvian reptiles" to be discovered (by Mary Anning), and excited great interest in Victorian England. It was so-named ("more lizard") by William Conybeare, to indicate that it was more like a normal reptile than Ichthyosaurus, which had been found in the same rock strata just a few years previously.

Description

The snout is short, but the mouth was able to open very wide, and the jaws are provided with a series of conical teeth in sockets, much like those of the living gavial. The neck is long and slender, but seems to have been rather stiff, because the vertebrae are nearly flat-ended, which indicates that it could not have been bent in the swan-fashion represented in many old restorations. The other vertebrae are similarly almost flat-ended and firmly united, and there is no sacrum. The ribs are single-headed, and in the middle of the trunk, between the supports of the paired limbs, they meet a dense plastron of abdominal ribs. The short tail is straight and rapidly tapering,

The pectoral and pelvic girdles which support the paired limbs are greatly expanded, the pectoral arch being similar to the corresponding bones of turtles.

The limbs are elongated paddles, with five complete digits, although each consists of a very large number of phalanges. Some traces of skin discovered suggest that it was smooth, not scaly.

Lifestyle

Plesiosaurus was exclusively marine, feeding on belemnites, fishes and other prey. It propelled itself by the paddles, the tail being too short to be of much use.

Species

At one time, *Plesiosaurus* was a wastebin taxon used to describe any Mesozoic plesiosaur of generally similar appearance. More recently there has been a number of revisions in sauropterygian taxonomy, and many species previously included here have been moved to other genera and families. Only two species are unambiguously recognised.

Plesiosaurus dolichodeirus is the type species, known from the Lower Lias (Sinemurian) of Lyme Regis, which was about three metres long. Other plesiosauria from the same formation seem to have measured five to six metres in length.

Plesiosaurus guilelmiimperatoris is known from a large almost complete skeleton from the Upper Lias (Toarcian) of Württemberg. There seems to be the impression of a rhomboidal flap of skin in a vertical plane; if so, many plesiosaurs may have been equipped in this way.

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Pliosaur

Fossil range: Rhaetian to Cretaceous
Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Superorder: Sauropterygia
Order: Plesiosauria
Suborder: **Pliosauroidea,** Welles, 1943
Families and genera
Thalassiodragon
Archaeonectrus
Attenborosaurus
Eurycleidus
Rhomaleosauridae
Leptocleididae
Pliosauridae
Brachauchneiidae

The **Pliosaurs** were aquatic mesozoic reptiles, from the Jurassic and Cretaceous Periods. They originally included members of the family Pliosauridae, in the order Plesiosauria, but several other genera and families are now also included, the number and details of which vary according to the classification used. The name is derived from Greek: *À»µ¹É* from the verb 'to sail' or *À»µ¹É½* meaning 'fin' and *Ã±ÅÁ¿Â* meaning 'lizard'.

This group was characterised by having a short neck and an elongated head, in contrast to the long-necked plesiosaurs. They were more crocodile-shaped. However, the four-paddle swimming action, using the large flipper-like limbs was shared with plesiosaurs and they were possibly better adapted to deeper waters. They were carnivorous and their long and powerful jaws carried many sharp teeth. Their prey may have been ichthyosaurs and other plesiosaurs.

Typical genera include Macroplata, Kronosaurus, Liopleurodon, Pliosaurus and Peloneustes. Fossil specimens have been found in England, South America, and the Arctic region near Norway.

Many very early (from the Rhaetian (Latest Triassic) and Early Jurassic) primitive pliosaurs were very like plesiosaurs in appearance and indeed used to be included in the family Plesiosauridae.

These aquatic reptiles were not dinosaurs.

See also

- Plesiosaur

Squamata

Scaled reptiles

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: **Squamata,** Oppel, 1811
Suborders
Lacertilia- Lizards
Serpentes - Snakes
Amphisbaenia - Worm lizards

Squamata (scaled reptiles) is the largest recent order of reptiles, including lizards and snakes. Members of the order are distinguished by their skins, which bear horny scales or shields. They also possess movable quadrate bones, making it possible to move the upper jaw relative to the braincase. This is particularly visible in snakes, which are able to detach their jaws entirely to accommodate very large penises. The male members of the group Squamata are the only vertebrates with a hemipenis. This is also the only reptile group where we can find both viviparous and ovoviviparous species, as well as the usual oviparous reptiles.

Classically, the order is divided into three suborders:

- Lacertilia, the lizards;
- Serpentes, the snakes;
- Amphisbaenia, the worm lizards.

Of these, the lizards form a paraphyletic group. In newer classifications the name Sauria is used for reptiles and birds in general, and the Squamata are divided differently:

- Suborder Iguania (the iguanas and chameleons)
- Suborder Scleroglossa
  - Infraorder Gekkota (the geckos)
    Infraorder Anguimorpha (the monitors, goannas, Komodo dragon, Gila monster, and slow-worms)
    Infraorder Scincomorpha (skinks and common European lizards)
    Infraorder Serpentes (the snakes)
    Infraorder Amphisbaenia

The exact relationships within these two suborders are not entirely

certain yet, though recent research strongly suggests that several families form a venom clade which encompasses a majority (nearly 60%) of Squamate species.

The Squamata do not include the tuataras, New Zealand reptiles resembling lizards.

Lizards | Snakes | Pythonomorpha | Toxicofera

Lizards

Fossil range: Jurassic - Recent
Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Suborder: **Lacertilia,** Günther, 1867
Families: Many, see text.

Lizards are reptiles of the order Squamata, which they share with the snakes (Ophidians). They are usually four-legged, with external ear openings and movable eyelids. Species range in adult length from a few centimeters (some Caribbean geckos) to nearly three meters (Komodo dragons).

Some lizard species called "glass snakes" or "glass lizards" have no functional legs, though there are some vestigial skeletal leg structures. They are distinguished from true snakes by the presence of eyelids and ears. The tail of glass lizards, like many other lizards, will break off as a defense mechanism, unlike snakes.

Many lizards can change color in response to their environments or in times of stress. The most familiar example is the chameleon, but more subtle color changes occur in other lizard species as well (most notably the anole, also known as the "house chameleon" or "chamele").

Lizards typically feed on insects or rodents. A few species are omnivorous or herbivorous; a familiar example of the latter is the iguana, which is unable to properly digest animal protein. Until very recently, it was thought that only two lizard species were venomous: the Mexican beaded lizard and the closely-related Gila monster, both of which live in northern Mexico and the southwest United States. However recent research at the University of Melbourne, Australia and Pennsylvania State University has revealed that in fact many lizards in the iguanians and monitor (lizard) families have venom-producing glands. None of these poses much danger to humans, as their poison is introduced slowly by chewing, rather than injected as with poisonous snakes. Nine toxins previously thought to only occur in snakes have been discovered, and a number of previously unseen chemicals as well.

These revelations are prompting calls for a complete overhaul of the classification system for lizard species to form a venom clade. "These papers threaten to radically change our concepts of lizard and snake evolution, and particularly of venom evolution," says Harry Greene, a herpetologist at Cornell University in New York.

Most other lizard species are harmless to humans (most species

native to North America, for example, are incapable even of drawing blood with their bites). Only the very largest lizard species pose threat of death; the Komodo dragon, for example, has been known to attack and kill humans and their livestock. The Gila Monster and Beaded Lizard are venomous however, and though not deadly, can inflict extremely painful and powerful bites. The chief impact of lizards on humans is positive; they are significant predators of pest species; numerous species are prominent in the pet trade; some are eaten as food (for example, iguanas in Central America); and lizard symbology plays important, though rarely predominant roles in some cultures (e.g. Tarrotarro in Australian mythology).

Most lizards lay eggs, though a few species are capable of live birth. Many are also capable of regeneration of lost limbs or tails.

Lizards in the Scincomorpha family, which include skinks (such as the blue-tailed skink), often have shiny, iridescent scales that appear moist. However, like all other lizards, they are dry-skinned and generally prefer to avoid water. All lizards are able to swim if needed, however, and a few (such as the Nile monitor) are quite comfortable in aquatic environments.

Lizards as pets

Many species of lizard are now sold as pet species. A few of these include iguanas, bearded dragon, leopard geckos, tegus, and monitor lizards to name a few. In general, lizards require more maintenance than other exotic pets, particularly snakes and tarantulas. Their feces are usually more offensive, requiring frequent cage cleanings.

Classification

Suborder Lacertilia (Sauria) - (Lizards)

- †Family Bavarisauridae
- †Family Eichstaettisauridae
- Infraorder Iguania
    - †Family Arretosauridae
      †Family Euposauridae
      Family Corytophanidae (casquehead lizards)
      Family Iguanidae (iguanas and spinytail iguanas)
      Family Phrynosomatidae (earless, spiny, tree, side-blotched and horned lizards)
    - Family Polychrotidae (anoles)
        - Family Leiosauridae (see Polychrotinae)
    - Family Tropiduridae (neotropical ground lizards)
        - Family Liolaemidae (see Tropidurinae)
          Family Leiocephalidae (see Tropidurinae)
    - Family Crotaphytidae (collared and leopard lizards)
      Family Opluridae (Madagascar iguanids)
      Family Hoplocercidae (wood lizards, clubtails)
      †Family Priscagamidae
      †Family Isodontosauridae
      Family Agamidae (agamas)
      Family Chamaeleonidae (chameleons)
- Infraorder Gekkota
    - Family Gekkonidae (geckos)
      Family Pygopodidae (legless lizards)
      Family Dibamidae (blind lizards)
- Infraorder Scincomorpha
    - †Family Paramacellodidae
      †Family Slavoiidae
      Family Scincidae (skinks)
      Family Cordylidae (spinytail lizards)
      Family Gerrhosauridae (plated lizards)
      Family Xantusiidae (night lizards)
      Family Lacertidae (wall lizards or true lizards)
      †Family Mongolochamopidae
      †Family Adamisauridae
      Family Teiidae (tegus and whiptails)
      Family Gymnophthalmidae (spectacled lizards)
- Infraorder Diploglossa
    - Family Anguidae (glass lizards)
      Family Anniellidae (American legless lizards)

Family Xenosauridae (knob-scaled lizards)

- Infraorder Platynota (Varanoidea)
  - Family Varanidae (monitor lizards)
    Family Lanthanotidae (earless monitor lizards)
    Family Helodermatidae (gila monsters)
    †Family Mosasauridae (marine lizards)

List of Lacertilia families | Agamas | Anguids | Anoles | Blind lizards | Chameleons | Collared lizards | Corytophanids | Geckos | Helodermas | Iguanas | Legless lizards | Leiosaurids | Liolaemids | Monitor lizards | Mosasaurs | Night lizards | Oplurids | Plated lizards | Phrynosomatids | Skinks | Spectacled lizards | Tropidurids | Spinytail lizards | Wall lizards | Whiptail lizards | Wood lizards | Xenosaurids

List of Lacertilia families

Lizards

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Suborder: **Lacertilia,** Günther, 1867

This is a list of the extant Lacertilia families. Larcertilia is the suborder of reptiles commonly known as lizards.

Taxonomy

There are five infraorders which separate the lizards, these are: Diploglossa, Gekkota, Iguania, Platynota and Scincomorpha. This separation is based mainly on morphological similarities between family groups.

The Diploglossans and Platynotans are two closely related infraorders which are have very diverse families. Very few generalisations can be placed upon these families morphologically. Many species are limbless, while others have fully formed limbs. It is believed that these lizards are the closest lizard relation to the snakes.

The Gekkotans are the second most diverse group of lizards. They can be morphologically distinguished by the absence of temporal arches, which allows greater moveability of the head. Most species also have cloacal sacs and fixed eyelids.

The Iguanians are another diverse group of lizards. All iguanians are fully limbed. Most species ambush their prey, capture it with their tongue and have skin modification, such as crests and fans, used for many different reasons.

The Scincomorphans are the most diverse group of lizards, accounting for almost half the speices of lizards. The major distinguishing morphological feature of the Scincomorphs, is the presence of unsocketed teeth on the inner face of the jaw bones. They also lack the skin modifications present in many of the iguanians. This family contains varying degrees of limb reduction, from completely formed limbs to completely absent of limbs.

As with most taxonomic classifications, there are many different interpretations of the evolutionary relationships. These include moving of familes to different infraorders, merging or splitting of the infraorders and merging and splitting of the families.

Diploglossa

Family	Common Names	Example Species
Anguidae Oppel, 1811	Glass lizards	Slow Worm (*Anguis fragilis*)
Anniellidae Gray, 1852	American legless lizards	California Legless Lizard (*Anniella pulchra*)
Xenosauridae Cope, 1866	Knob-scaled lizards	Chinese Crocodile Lizard (*Shinisaurus crocodilurus*)

Gekkota

Family	Common Names	Example Species

Dibamidae Boulenger, 1884	Blind lizards	*Dibamus* - *nicobaricum*
Gekkonidae Gray, 1825	Geckos	Thick-tailed Gecko (*Underwoodisaurus milii*)
Pygopodidae Boulenger, 1884	Legless lizards	Burton's Snake-Lizard (*Lialis burtonis*)

Iguania

Family	Common Names	Example Species
Agamidae Spix, 1825	Agamas	Eastern Bearded Dragon (*Pogona barbata*)
Chamaeleonidae Gray, 1825	Chameleons	Veiled Chameleon (*Chamaeleo calyptratus*)
Corytophanidae Frost & Etheridge, 1989	Casquehead lizards	Plumed Basilisk (*Basiliscus plumifrons*)
Crotaphytidae Frost & Etheridge, 1989	Collared and leopard lizards	Common Collared Lizard (*Crotaphytus collaris*)
Hoplocercidae Frost & Etheridge, 1989	Wood lizards or clubtails	Club-tail Iguana- (*Hoplocercus spinosus*)
Iguanidae	Iguanas	Marine Iguana (*Amblyrhynchus cristatus*)
Leiosauridae Frost et al., 2001	-	Darwin's Iguana- (*Diplolaemus darwinii*)
Opluridae Frost & Etheridge, 1989	Madagascan iguanas	Chalarodon - (*Chalarodon madagascariensis*)
Phrynosomatidae Frost & Etheridge, 1989	Earless, spiny, tree, side-blotched and horned lizards	Greater Earless Lizard (*Cophosaurus texanus*)
Polychrotidae Frost & Etheridge, 1989	Anoles	Caronlina Anole (*Anolis carolinensis*)

Tropiduridae Frost & Etheridge, 1989	Neotropical ground lizards	(*Microlophus peruvianus*)

Platynota

Family	Common Names	Example Species
Helodermatidae	Gila monsters	Gila Monster (*Heloderma suspectum*)
Lanthanotidae	Earless Monitor	Earless Monitor- (*Lanthanotus borneensis*)
Varanidae	Monitors lizards	Perentie (*Varanus giganteus*)

Scincomorpha

Family	Common Names	Example Species
Cordylidae	Spinytail lizards	Girdle-tailed Lizard (*Cordylus warreni*)
Gerrhosauridae	Plated lizards	Sudan Plated Lizard (*Gerrhosaurus major*)
Gymnophthalmidae	Spectacled lizards	- -
Lacertidae Oppel, 1811	Wall or true lizards	Eyed Lizard (*Lacerta lepida*)
Scincidae Oppel, 1811	Skinks	Western Blue-tongued Skink (*Tiliqua occipitalis*)
Teiidae	Tegus or whiptails	Blue Tegu (*Tupinambis teguixin*)
Xantusiidae	Night lizards	Granite Night Lizard (*Xantusia henshawi*)

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Agamas

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Sauria
Family: Agamidae
Subfamily: Agaminae
Genus: ***Agama***
Species: See text.

Any of various small, long-tailed, insect-eating lizards of the genus ***Agama***. The agamid genus is comprised of at least 31 species across Africa.

One of the best known species is the **red-headed rock agama** (*Agama agama*), widespread in sub-Saharan Africa. Its original habitat is the savanna, but today it also lives within villages and towns. These agamas form groups of ten to twenty. The "leader" is an old male, while females and young males constitute the other members of the group. The colour is dark brown at night, but after dawn the colours of the dominant male will change: the body becomes light blue, head and tail bright orange. These colours may change again depending on the dominant male's mood. For instance, if male agamas fight, their heads will turn brown, and white spots appear on their body. Fights take place when a foreign agama male appears. It will try to dispute the leadership of the dominant male. When fighting, agamas hiss and attempt to hit each other's head with their tail. These strokes may be very violent and often result in haematomas or fractured jaws.
The females in the group are entirely brown. Often there is a highest-ranking female that remains in proximity to the leading male and struggles to repel other females.

Species

The following species are classified within the genus *Agama*:

- Agama aculeata
  Agama agama (agama lizard)
  Agama anchietae
  Agama armata
  Agama atra
  Agama bocourti
  Agama bottegi
  Agama boueti
  Agama boulengeri

- Agama caudospinosa
  Agama cornii
  Agama doriae
  Agama etoshae
  Agama gracilimembris
  Agama hartmanni
  Agama hispida
  Agama impalearis
  Agama insularis
  Agama kirkii
  Agama mehelyi
  Agama montana
  Agama mossambica
  Agama mwanzae
  Agama paragama
  Agama persimilis
  Agama planiceps
  Agama robecchii
  Agama rueppelli
  Agama sankaranica
  Agama spinosa
  Agama weidholzi

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Central Bearded Dragon

Central Bearded Dragon

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Sauria
Family: Agamidae
Genus: *Pogona*
Species: ***P. vitticeps***
Binomial name ***Pogona vitticeps,*** Ahl, 1926

The **Central Bearded Dragon** or **Inland Bearded Dragon** (*Pogona vitticeps*) is a type of agamid lizard. Of the several species of the Pogona genus, P. vitticeps is the most commonly seen breed in pet stores throughout the world.

Adult central bearded dragons usually grow to be about two feet in length, with the tail accounting for over half of the total body length. Females are typically smaller than the males. Bearded dragons come in a wide variety of colors, including brown, gray, reddish-brown, and even orange. They are capable of undergoing very slight changes in the shade of their color to help regulate temperature. The specialized scales along both sides of the throat, neck, and head form many narrow spines which run down the side of the body to the tail. When feeling threatened a bearded dragon will flatten its body against the ground, puff out its spiny throat, and open its jaws to make itself appear larger. The bearded dragon is so named because of the spiny throat projections appear similar to a human beard. Males typical have a darker "beard" than females, and during mating season and courtship the "beard" will typically darken to near-black. The bearded dragon, like most agamid lizards, has strong legs which enable it to lift its body completely off the ground while it moves. This is done to reduce the heat taken in from the ground, as well as to increase the air-flow over the belly to cool itself further.

The central bearded dragon is native to the semi-arid to and arid woodlands and rocky desert regions of Central Australia. They are skilled climbers, and often spend just as much time perching on tree limbs, fenceposts, and in bushes than they do on the ground. They spend much of the morning and evening sunning themselves on top of an exposed branch or rock. They are diurnal, but like most desert animals they spend the hottest parts of the day hiding in underground burrows or any other cool hiding spot removed from direct sunlight.

Central bearded dragons are omnivorous. They are voracious eaters, feeding on insects and other invertebrates, and are known to

sometimes eat small vertebrates, such as mice, as well. They also occasionally eat soft plant matter such as green leaves, fruits and vegetables, and flowers.

Central bearded dragons reach full sexual maturity around two years of age. Breeding typically occurs in the early summer. Females will lay a clutch of eleven to sixteen oblong-shaped eggs in a shallow nest dug in the sand. After being laid the eggs are left unattended. The eggs will hatch approximately three months later.

Anguids

Anguidae

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Sauria
Family: **Anguidae**
Genera
Anguis
Ophisaurus
Pseudopus
Celestus
Diploglossus
Ophiodes
Abronia
Barisia
Coloptychon
Elgaria
Gerrhonotus
Mesaspis

Classification

Family Anguidae

- **Subfamily Anguinae**
  - Genus Anguis
    Genus Ophisaurus
    Genus Pseudopus
- **Subfamily Diploglossinae**
  - Genus Celestus
    Genus Diploglossus
    Genus Ophiodes
- **Subfamily Gerrhonotinae**
  - Genus Abronia
    Genus Barisia
    Genus Coloptychon
    Genus Elgaria
    Genus Gerrhonotus
    Genus Mesaspis

Anoles

Polychrotidae

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Iguania
Family: **Polychrotidae**
Genera
Anisolepis
Anolis
Chamaeleolis
Chamaelinorops
Ctenonotus - Eastern Antillean Anoles, Eastern Antillian Anoles
Dactyloa - South American anoles
Diplolaemus
Enyalius
Leiosaurus
Norops
Phenacosaurus
Polychrus
Pristidactylus
Urostrophus
Xiphosurus - Hispaniolan giant anole, Puerto Rican giant anole

Polychrotidae is a family of lizards commonly known as **Anoles**. Some authorities (such as *NCBI* [[1]]) place the anoles in subfamily **Polychrotinae** of the family Iguanidae. Four genera are common: Anolis, Norops, Phenacosaurus and Polychrus. They are frequently and incorrectly called chameleons or geckos, although they are not biologically classified within or closely related to either of these groups. These misconceptions are likely due to their ability to alter their skin color and run up walls, respectively.

Contents

Overview

Anoles are small and common lizards that can be found throughout the southeastern United States, the Caribbean, and various other regions of the western world. A large majority of them sport a green coloration, including the only species native to North America, the aptly named Green anole, although the green anole can change its color based on its mood and surroundings. Anoles are an exorbitantly diverse and plentiful group of lizards. There are currently well over 300 known species. The knight, green, bark, and Cuban brown anoles can all be found in the United States, primarily in Florida, although the most prevalent of these species by far is the Cuban brown anole, which has pushed the native green (or "Carolina") anole population farther north. All species of anole in the U.S. except the green anole were introduced through eggs nested in imported plants. It is notable that while nearly all anoles can change their color, the extent and variations of this ability differ wildly throughout the individual anole species. For example, the green anole can change its color from a bright, leafy green to a dull brown color, while the Cuban brown can only change its shade of brown, along with the patterns on its back.

Many anoles are between 8 and 18 cm (3–7 inches) in length. Some larger species, such as the Knight Anole, can surpass 12 inches, some males of the Knight Anole species can even reach two feet.

Anoles thrive on live insects and other invertebrates with moths and spiders being some of the most commonly consumed prey. Anoles are opportunistic feeders, and may attempt to eat any attractive meal that is small enough. The primary food for captive anoles are small feeder crickets that can be purchased at most pet stores.

These subtropical lizards are semiarboreal. They usually inhabit regions around 3–6 m (10–20 feet) high. Shrubs, walls, fences, bushes, and short trees are common hiding places.

Most anoles are said to live between 3 and 5 years. Even anoles captured from the wild can live for several years if given acceptable living space and cared for properly—a healthy anole in captivity, being free from predators and natural disaster, may live well beyond seven years.

Breeding occurs for several months beginning in late spring. Males employ head bobbing and dewlap extension in courtship. 1–2 small, softshell eggs are laid among leaf litter. More clutches may be laid before mating season has ended.

Miscellaneous

Anoles have many features that make them readily identifiable. They have a dewlap, made of erectile cartilage, that extends from the neck/throat area. For example: If an intruder approaches, the male will compress its body, extend the dewlap, and bob its head. Their toes are covered with structures that allow them to cling to many different surfaces. Also, their tails have the ability to break off at special segments in order to escape predators or fights. The tail itself continues to wriggle strongly for some minutes after detaching. This ability is known as autotomy. Anoles are also diurnal, which means that they are active during the daytime.

Anoles, though defensive and territorial, are usually shy. They will often flee when faced with overwhelming danger. They are also very easily stressed. For these reasons, as well as others, it's highly recommended that any keeper avoid handling his anoles as much as possible.

Anoles, though relatively inexpensive themselves, are amazing lizards to keep and raise. They require somewhat intricate setups to mimic their subtropical habitats. It's often difficult for most people to imagine such a "cheap" lizard as being such a responsibility. This is why many pet anoles are considered to be neglected.

Blind lizards

Dibamidae

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Sauria
Family: **Dibamidae**

A poorly known group of legless lizards native to southern Australia and SE Asia, found in tropical forests. These lizards have a rigidly fused skull, no pterygoid teeth, reduced eyes, and no external ears. They have only their rear limbs, which are flap-like and used during mating by the male. They are egg-layers.

Classification

Family Dibamidae

- Genus Anelytropsis
- Genus Dibamus

Chameleons

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Sauria
Family: **Chamaeleonidae**
Genera
Bradypodion
Calumma
Chamaeleo
Furcifer
Brookesia
Rhampholeon

Chameleons (family **Chamaeleonidae**) are squamates that belong to one of the best-known lizard families. They are known for their ability to change their color, their elongated sticky tongue, and for their eyes which can be moved independently of each other. The name "chameleon" means, "Earth lion" and is derived from the Greek words "chamai" (on the ground, on the earth) and "leon" (lion).

Contents

Description

Chameleons vary greatly in size and body structure, from the less than 4 in (10 cm) Brookesia species, to the 24 in (60 cm) Calumma parsonii. There is even one species, thought to be unique to Malawi's Mount Mulanje, which is barely 1.5cm across when fully grown. Many have head or facial ornamentation, be it nasal protrusions or even horn-like projections in the case of Chamaeleo jacksonii, or large crests on top of their head, like Chamaeleo calyptratus. Many species are sexually dimorphic, and males are typically much more ornamented than the females.

The main things chameleon species do have in common is their foot structure, their eyes, their lack of ears, and their tongue:

Chameleons have feet that are split into two main "fingers", with a soft pad in between. These "fingers" are equipped with sharp claws to gain traction on surfaces such as bark when climbing. An interesting fact about chameleons is that they have two claws on the outside of their front foot and three on the inside, yet on the back foot this is reversed.

Their eyes are the most distinctive among the reptiles. The upper and lower eyelids are joined, with only a pinhole large enough for the pupil to see through. They can rotate and focus separately to observe two different objects simultaneously. It in effect gives them a full 360-degree arc of vision around their body. When prey is located, both eyes can be focused in the same direction, giving sharp stereoscopic vision and depth perception.

They lack a vomeronasal organ. Like snakes, they don't have an outer or a middle ear and seem to be deaf; at least they cannot detect airborne sounds. But some, maybe all, can communicate via vibrations that travel through solid material like branches.

Chameleons have incredibly long tongues (sometimes longer than their own body length) which they are capable of extending out of the mouth at a rapid rate. It has a sticky tip on the end, which serves to catch prey items that they would otherwise never be able to reach with their lack of locomotive speed. The tongue's tip is a bulbous ball of muscle, and as it hits its prey, the tongue rapidly forms a small suction cup. Once the tongue sticks to a prey item, it is drawn quickly back into the mouth, where the chameleon's strong jaws crush it and it is consumed. Even a small chameleon is capable of eating a large locust or mantis.

Distribution and habitat

The main distribution of Chameleons is Africa and Madagascar, and other tropical regions, although some species are also found in parts of southern Europe and Asia . There are introduced, feral populations of veiled and Jackson's chameleons in Hawaii and isolated pockets of feral Jackson's chameleons have been reported in California and Florida.

Different members of this family inhabit all kinds of tropical and montane rain forests, savannas and sometimes semi-deserts and steppes. Chameleons are mostly arboreal and are often found in trees or occasionally on smaller bushes. Some smaller species, however, live on the ground under foliage.

Reproduction

Most chameleons are oviparous, and lay eggs after a 3-6 week gestation. Once the eggs are ready to be laid, the female will climb down to the ground and begin digging a hole, anywhere from 4-12 inches (10-30 cm) deep depending on the species. The female turns herself around at the bottom of the hole and deposits her eggs. Once finished, the female buries the eggs and leaves the nesting site. Clutch sizes vary greatly with species. Small Brookesia species may only lay 2-4 eggs, while large Veiled chameleons (Chamaeleo calyptratus) have been known to lay clutches of 80-100 eggs. Clutch sizes can also vary greatly among the same species. Eggs generally hatch after 4-12 months, again depending on species. The eggs of the rare Parson's chameleon (Calumma parsonii) are believed to take upwards of 24 months to hatch.

Some species of chameleons, such as Jackson's chameleon (Chamaeleo jacksonii) and the Flapjack chameleon (Chamaeleo fuelleborni), are viviparous, giving birth to live young. This gestation takes 4-6 months depending on the species.

Diet

Chameleons generally eat locusts, mantids, crickets, and other insects, but larger chameleons have been known to eat small birds and other lizards. A few species, such as *Chamaeleo calyptratus* have been known to consume small amounts of plant matter. Chameleons prefer running water to still water.

It was commonly believed in the past that the chameleon lived on air, and didn't consume any food at all. This belief is today represented in symbolic form, with the chameleon often being used as a motif to signify air.

Change of color

Some Chameleon species are able to change their body color, which has made them one of the most famous lizard families. Most chameleons don't really change color because of their background, (although the surroundings play a large part) but also an expression of the physical and physiological condition of the lizard. The skin color is changed under influence of mood, light, and temperature. The skin color also plays an important part in communication and rivalry fights.

Chameleons have specialized cells, collectively called chromatophores, that lie in layers under their transparent outer skin. The cells in the upper layer, called xanthophores and erythrophores, contain yellow and red pigments respectively. Below these is another layer of cells called iridophores or guanophores, and they contain the colorless crystalline substance guanine. These reflect amongst others the blue part of incident light. If the upper layer of chromatophores appears mainly yellow, the reflected light becomes green (blue plus yellow). A layer of dark melanin containing melanophores is situated even deeper under the reflective iridophores. The melanophores influence the 'lightness' of the reflected light. All these different pigment cells can rapidly relocate their pigments, thereby influencing the color of the chameleon.

In captivity

Numerous species of chameleon are available in the exotic pet trade. *Ch. (Tr.) jacksonii ssp.* and *Ch. calyptratus* are by far the most common, and are frequently captive-bred. Most species of chameleons are listed on CITES, and therefore are either banned from exportation from their native countries or have strict quotas placed on the numbers exported. However, lack of enforcement in what are mostly poor countries reduces the effectiveness of this listing. However, captively bred animals of the most popular species (Panther, Veiled, and Jackson's) are readily found.

Other species

Due to a limited ability to change color, anoles are sometimes confused with chameleons, and are occasionally referred to as "American chameleons."

Collared lizards

Crotaphytidae

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Suborder: Sauria
Family: **Crotaphytidae**

Crotaphytid lizards or more commonly known as Collared lizards are found in North America only (American southwest and northern Mexico). They typically prey on other lizards and other vertebrates for their sustenance. There are 12 species found in two genera (below).

Family Crotaphytidae

- Genus Gambelia (Leopard lizards)
  Genus Crotaphytus (Collared lizards)

Corytophanids

Corytophanidae

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Suborder: Sauria
Family: **Corytophanidae**

Corytophanidae is a family of lizards also called casque head lizards. They typically have well-developed head crests in the shape of a casque. The casque head is a sexually dimorphic character, found only on males. There are 9 known species of casqu heads from 3 genera (below).

Classification

Family Corytophanidae

- Genus Basiliscus
  Genus Corytophanes
  Genus Laemanctus

Geckos

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Lacertilia
Family: **Gekkonidae,** Gray, 1825
Subfamilies
Aeluroscalabotinae
Eublepharinae
Gekkoninae
Teratoscincinae
Diplodactylinae

Geckos are small to moderately large lizards belonging to the family **Gekkonidae** which are found in warm climates throughout the world. Geckos are unique among lizards in their vocalizations, making chirping sounds in social interactions with other geckos. Geckos are unusual in other respects as well. Most geckos have no eyelids and instead have a transparent membrane which they lick to clean. A few species have the ability to shoot an irritating liquid out of the end of their tails. They are also known to have the ability to change the colour of their skins although they have not mastered it like the chameleons and can only go pale. Many species have specialized toe pads that enable them to climb smooth vertical surfaces and even cross indoor ceilings with ease. These antics are well-known to people who live in warm regions of the world where several species of geckos make their home inside human habitations. These species (for example the House gecko) become part of the indoor menagerie and are seldom really discouraged because they feed on insect pests.

Most geckos are tan to dark grey, subtly patterned, and somewhat rubbery looking. Some species can change color to blend in with their surroundings or with temperature differences. However others can be brightly colored.

Some species are parthenogenic, the females capable of reproducing without copulating with a male. This improves the geckos' ability to spread to new islands.

The toes of the gecko have attracted a lot of attention, as they adhere to a wide variety of surfaces, without the use of liquids or surface tension. Recent studies of the Spatula tipped setae on gecko footpads demonstrates that the attractive forces that hold geckos to surfaces are van der Waals interactions between the finely divided setae (almost 500,000 Setae on each foot, and each of these tipped

with between 100 and 1,000 spatulae) and the surfaces themselves. These kinds of interactions involve no fluids; in theory, a boot made of synthetic setae would adhere as easily to the surface of the International Space Station as it would to a living room wall. Geckos toes are extremely double jointed, allowing them to overcome the van der Waals force by peeling their toes off surfaces from the tips inward. In essence, this peeling action alters the angle of incidence between millions of individual setae and the surface, reducing the van der Waals force. Amazingly, Geckos only operate well below their full attractive capabilities for most of the time. This is because there is a huge margin for error depending upon the roughness of the surface, and therefore the number of Spatulae in contact with that surface. If a gecko had every one of its spatulae in contact with a surface, it would be capable of holding aloft a 120Kg man.

The family Gekkonidae is divided into five different subfamilies, containing numerous different genera of gecko species. Many geckos are kept as pets and will eat various kinds of insects and sometimes fruit.

In the past few years, geckos have entered the collective consciousness as the advertising icon for the insurance company GEICO, whose television advertisements feature an animated anthropomorphic gecko character that speaks English with a South London (England) accent.

Common species of gecko

- **Crested Gecko**, *Rhacodactylus ciliatus(* — Until recently believed extinct. Gaining in popularity as a pet.
- **Crocodile or Moorish gecko**, *Tarentola mauritanica* — Crocodile geckos are very strong and heavily built for their size usually growing up to 15.24 cm (6 in). They are commonly found in the Mediterranean region from the Iberian Peninsula and southern France to Greece and northern Africa. Their most distinguishing characteristic is their pointed head and spiked skin with their tail resembling that of a crocodile's.
- **Gargoyle Gecko**, *Rhacodactylus auriculatus* — commonly known as the New Caledonian bumpy gecko or Gargoyle gecko.
- **Golden gecko**, *Gekko ulikovski* — native to the warm rainforests of Vietnam.
- **House Gecko**, *Hemidactylus frenatus* — A species that thrives around man and human habitation structures in the tropics and subtropics world wide.
- **Indo-Pacific gecko**, *Hemidactylus garnoti* — Also known as a **fox gecko** because of its long, narrow snout. This species is found in houses throughout the tropics. This gecko may eat leafcutter ants.
- **Leachianus Giant Gecko**, *Rhacodactylus leachianus* — first described by Cuvier in 1829, is the largest of the Rhacodactylus geckos.
- **Leopard gecko**, *Eublepharis macularius* — The most common gecko kept as a pet is the leopard gecko, which does not have toe pads with setae, but rather claws. These enable it to more easily climb on rough surfaces like tree bark. This gecko cannot climb the glass of a terrarium. The leopard gecko tends to be docile and calm. This gecko can eat cockroaches, crickets, mealworms, waxworms, and superworms.
- **Mediterranean gecko**, *Hemidactylus turcicus* — residential and wild, introduced species (USA).
- **Mourning gecko**, *Lepidodactylus lugubris* — This species is equally at home in the wild as in residential neighborhoods. Found in Hawaii, it may have been an early Polynesian introduction. A parthenogenic species.
- **Stump-toed gecko**, *Gehyra mutilata* (=*Peropus mutilatus*) — This gecko can vary its color from very light to very dark to blend into a background. At home in the wild as well as in residential neighborhoods.
- **Tree gecko**, *Hemiphyllodactylus typus* — Tree geckos are forest

dwellers.

- **Tokay Gecko**, *Gekko Gecko* — a large, common, Southeast Asian gecko known for its aggressive temperament, loud mating calls, and bright markings.

References

- Forbes, Peter (4th Estate, London 2005) 'The Gecko's Foot - Bio Inspiration: Engineered from Nature' ISBN 0007179901 in H/B

Leopard gecko

Leopard gecko

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Sauria
Family: Gekkonidae
Subfamily: Eublepharinae
Genus: Eublepharis
Species: ***E. macularius***
Binomial name: ***Eublepharis macularius ,*** Blyth, 1854

The Leopard Gecko (***Eublepharis macularius***) is a nocturnal ground dwelling gecko commonly found in the desert areas of Pakistan, Northwestern India and Afghanistan. The etymology of their name is 'eu' = Good (=true) |'blephar' = Eyelid | 'macularius' = Spotted.

Contents

Characteristics

The leopard gecko gets its common name from the adult coloration of wild specimen, which is generally a cream to yellow ground color with black spots. However, artificial selection in captivity has produced a number of color morphs, distinct from this 'wild-type', possessing many varied colors and patterns. Some of these include: High yellow, orange, striped, patternless (no spots or stripes), lavender, blizzard (which are solid white or gray), and amelanistic (no black pigments in markings).

Leopard geckos are one of only a few gecko species (all of them members of the subfamily Eublepharidae, a small family of tropical/ subtropical species found in the Americas, Africa, and Asia.) that have eyelids. This helps the gecko keep its eyes clean and particle-free in its dusty environment. Most geckos clean and moisten their eyes with their tongues. Another interesting difference in leopard geckos from most other gecko species is the absence of adhesive toe pads. Instead, they have small claws. Leopard geckos cannot climb walls or glass, although their claws give extra traction on the ground and are helpful in digging; the same applies for the same group of old world geckos having eyelids. Like all geckos, they shed their tail if chased or grabbed. Although they will eventually grow a new one, the regenerated tail will differ from the original, appearing bulbous and inferior. If they are handled as a baby, they may become accustomed to handling.

In its natural environment, the leopard gecko lives under rocks or in small caves to avoid temperature extremes. Like many desert dwelling species it is most active at night, hunting insects, spiders, and small rodents as its prey.

Leopard geckos are only slightly sexually dimorphic, with the males being somewhat more heavy-bodied than females. Males possess a V-shaped row of enlarged pre-anal pores and a pair of hemipenal swellings at the base of the tail. Females have pre-anal pits and lack paired swelling at the base of the tail. Gender is differentiated during egg incubation and is dependent on the incubation temperature, but gender characteristics are not visible in young geckos. Incubation temperatures of 78-82 degrees produce males, 82-84 degrees produce both sexes, and 84-88 produce females.

As pets, leopard geckos will gradually adopt non-nocturnal behavior. The best way to ensure this is to handle them frequently, and only during day time.

Leopard Geckos in Captivity

Leopard geckos are widely considered to be a very good pet for a beginning herpetoculturist for several reasons: their small size, ease of care, cleanliness (they tend to defecate in one corner of their enclosure), long life span (up to 35 years), and wide color range. They can usually be handled well by older children with the close supervision of an adult, as their tails can fall off if stressed or frightened.

Leopard geckos are easily available commercially. They are one of the few lizard species regularly bred in captivity in large enough numbers that captive-produced specimens are easily obtained at pet stores. As with crested geckos, leopard geckos are a good choice for someone who wants a pet lizard but doesn't want to keep wild-caught animals. These geckos are very inexpensive especially in contrast to other reptiles and in the context of their beauty, tolerance of being handled, simplicity of care, simplicity to breed & other plusses.

A 'regular' leopard gecko generally consists of mostly yellow, black & green blotches & stripes. Such a gecko can be purchased at most pet stores that have a reptile department and will typically cost between $25-55.

In recent years, breeders have created special morphs of leopard geckos to obtain more attractive colouring patterns. These morphs range anywhere from costing $50 or so for a standard tangerine gecko, characterized by an orange body, to up to $2000 for geckos with special stripes, vivid colouring and so forth. Albino leopard geckos can cost over $100. Generally these expensive morphs will not be found in most pet stores & need to be ordered from breeders who specialize in selective bred or newly discovered morphs. Some may carry genetics for these morphs though. Most pet stores do however carry blizzard leopard geckos, characterized as the name implies by a white, often colourless skin. Many stores also carry albino leopard geckos which often have anything ranging from very pretty bands to no pattern at all.

Caring For Leopard Geckos

Choosing

When purchasing a leopard gecko, especially from a pet store,

check for signs of illness. One of the best indicators of health is the tail. A healthy leopard gecko will have a fat tail. Avoid purchasing a leopard gecko with a thin tail, as this indicates poor health. Also, they should have all of their digits and these should be thick all the way through. You can also ask the one you are buying from to throw a cricket into their tank to see if they have good appetite. Also beware when purchasing from pet stores because many non-reptile specializing stores will have and sell small adult gecko's (growth stunted at a juvenile size by under feeding), although these smaller gecko's may appear to be perfectly healthy, which they just might be, **it is advisable to only purchase an undersized adult with the purpose of keeping it as a pet and never attempting to breed it, as this may be dangerous** (bolded is an opinion and may not be true; however, it would appear to be the best course of action), also be cautioned that because of their smaller size they may be more sensitive than an average sized gecko.

Feeding

Leopard geckos feed almost exclusively on live insects. The most commercially-available insects are crickets, which are also the most nutritional staple food source for a leopard gecko. Always remember to periodically "dust" crickets with commercially available powdered calcium for reptiles. Crickets are inexpensive and can be kept in a Rubbermaid container along with a source of moisture and food (available commercially from several companies, or you can simply use a carrot or potato), or in small plastic boxes with egg box inside.

Locusts can be slightly more expensive than crickets and are generally enjoyed more by the gecko. A good food to keep the locusts alive and healthy is to feed them dandelion leaves coated in lizard vitamin powder.

Another possible staple food for leopard geckos are mealworms. Mealworms tend to be very fatty and will thus fatten your gecko up quickly. They can therefore be used as a treat as well (paragraph below) or to fatten geckos before breeding. When fed as a staple, regular mealworms (less than a centimetre each in length) should be used. When mealworms are fed, they can be placed in a small bowl in the gecko's enclosure and left to be consumed (always ensure that the bowl is tall enough that the mealworms cannot climb out of it). Mealworms not used for feeding can be stored for months at a time in a small container in a fridge. Mealworms are quite high in phosphorus.

Mealworms are also ideal if you plan on traveling. Leaving 50-70

mealworms in a bowl will satisfy two or three geckos for up to a week, as long as fresh water is supplied a couple times over that week. This should only be done when necessary (vacation, etc.) as after several days the insects will fully digest their "gutload" and will no longer offer the gecko the same level of nutritional value.

Treats should also be given to geckos occasionally if possible for variation in diet and extra nutrients. Silkworms are semi-attractive white insects that can be fed to geckos. Butterworms are high in fat and are a good supplement to a gecko's diet. Waxworms should be treated as treats and can be offered no more than twice a month due to their high fat content. Pinkie (baby) mice can also be fed to adult female geckos who are gravid.

Food items should be dusted in a calcium powder (available at pet stores) almost every other feeding. Products containing D-3 should not be used more than weekly as this substance can be dangerous in large doses. To dust, simply place food items in a small plastic bag with a bit of the calcium dust and shake. A small dish (such as a milk bottle top) of pure calcium should also be left in the enclosure at all times.

Feeding schedules are very subjective. Up until one year of age, geckos should be fed at least five times a week up to seven times a week with appropriately sized crickets. Adult geckos can be fed anywhere from every other day to two or three times weekly as long as they appear healthy and their tail (which contains fat reserves) remains healthy.

A small dish of purified water should be kept in the enclosure at all times and changed four or more times a week as needed.

It is important to note that all insects fed to a leopard gecko need to be "**gut loaded**". This is a process in which the insects are fed on a healthy diet which can consist of oats, fish food, bran flakes, cereal, fruit, etc. Many companies exist that produce commercial made gut load food. Without gut loading an insect is nothing more than a "empty shell" and offers little nuitritional value to the leopard gecko.

Many people new to keeping reptiles have heard an urban legend that mealworms can eat through a lizard's stomach, and that you need to decapitate mealworms before feeding them to a leopard gecko. These rumors are false; there are no confirmed cases of this occurring.

Housing

Many people own and house multiple geckos. They can be kept separately or in groups. Female leopard geckos are able to be housed in groups, but problems with stress and dominance are likely to occur, so it is not advised. If females are to be housed together then it is

important to offer enough space. A 35-gallon aquarium would be sufficient for three females (at least 10-gallons for every gecko). Males must be housed separately. They will fight over territory and some cases of fighting have lead to death of one or both of the geckos.

A male shouldn't be housed full-time with less than three females during breeding. The male's perpetual sex drive will stress out the females over time, so it is therefore advisable to house males in a separate enclosure from the females during non-breeding months. Adult leopard geckos of the opposite sex housed together will mate. Each female will deposit eggs every 4-6 weeks in increments of 1-2 eggs per laying. Female geckos are prone to calcium deficiencies with overly demanding deposition schedules. In gravid females are also prone to developing metabolic bone disease or becoming egg bound.

A 20 gallon aquarium can house a single adult gecko its entire life. Naturally, a 30 gallon would be more adequate and allow for a better thermal gradient.

For housing more than two adult geckos, a general rule to follow is to start at 20 gallons & add another 10 gallons for each additional gecko (i.e. 2 geckos = 30 gallons minimum; 4 = 50 etc).

Hides

A single Leopard gecko enclosure should contain at least 3 hides. A hide should reside on the warm end of the enclosure, one on the cool end of the enclosure, and the third should be a moist hide which is best located on the warmer side of the enclosure. Be aware that these geckos can not fly.

Hides need to be large enough to accommodate the geckos. Multiple hides of each type may be needed to avoid crowding.

Humid Hides

A humid hide (or moist hide) can aid in shedding and are good places for eggs to be laid. A humid hide can be fashioned from a plastic tub with a hole cut out of the side or top. The bottom of the humid hide can then be covered with dampened moss or paper towel. It is important that the moss or paper towel is damp at times of shedding. Without the increased humidity these shelters provide, unshed skin can not be left around the toes or tail tip. If this condition is allowed to persist, the tail tip or affected toes can be lost.

Substrate

Many leopard gecko owners still suggest the use of sand and other granular substrates, but these are known to be unsafe (especially calcium based sands such as repti-cal)to all leopard geckos, especially those under 5 inches.

Granular substrates have been known to cause impactions in leopard geckos. There are two types of impaction that could occur. The first is called an acute impaction. An acute impaction is when the leopard gecko swallows a large amount of substrate and it blocks the vital organs used to process food. (Stomach, intestinal tract, etc.) This type of impaction will lead to lethargy, lack of appetite, lack of bowel movements and sand in the stool.

The other type of impaction, and often the most deadly form, is the chronic impaction. A chronic impaction is the slow accumulation of sand that binds to the lining of the intestinal tract. Over time, and often years, it will create a blockage. This blockage will also have the same detrimental effects as an acute impaction. The biggest problem with this type of impaction is that when it is discovered, it is most often too late to cure. To prevent this possibility, avoid all granular substrates.

Substrates that are safe would include unprinted newspaper, paper towels, Repti carpet (making sure to keep check of any frayed edges), Non-adhesive shelf liner and slate / ceramic tile.

Linoleum can not be used because when heated it releases fumes from the adhesive which can be toxic. Cloth or regular carpet can also cause nails and claws to be caught and tangled.

Heating (daytime)

The most common and often the most preferred method of heating an enclosure for leopard geckos is with the use of an under tank heater (UTH) also known as heat mats.

UTHs adhere to the bottom of the glass aquariums and should be placed on one end and cover about 1/3 of the bottom of the enclosure. The spot in the enclosure that has the UTH under it will be considerably warmer than the rest of the enclosure. There should be a hide spot/spots placed over this location. This is where the geckos can receive the warmth required to aid in thermoregulation and digestion. The use of a thermostat will allow you to change the amount of heat that is emitted by the UTH.

Other methods of heating an enclosure are ceramic heat emitters and basking lights. Heat rocks should not be used in reptile

enclosures, as these will cause thermal burns.

The ideal temperature range to house a leopard gecko at would be 88-92°F in the warmer side of the enclosure (where the UTH or heating device is located.) The cooler end of the enclosure should not fall below 77°F but should also not exceed 84°F. There should be a hide spot located on this end of the enclosure as well.

The purpose of having this type of setup is to allow the gecko to thermoregulate its body temperature. Unlike humans, geckos are cold blooded. They depend upon external heat sources and cool spots to adjust their bodies' core temperature. If a proper heat gradient is not supplied, the gecko could become too cool or hot and become ill or die. One of the most common mistakes first-time keepers of leopard geckos make is not giving the geckos warm and cool hiding places in their enclosures. If hiding places are provided only in the cool end of the enclosure, the geckos may stay on the "cool side" all day. If heating systems are turned off at night when the geckos emerge, they will not have the chance to raise their body temperatures high enough to properly digest food. This is especially dangerous for juveniles, which need to eat more often than adults.

Heating (night time)

In the wild, evening temperatures differ from those during the day. This can be duplicated in captivity as well, although the geckos will appreciate warm temperatures at night. A nightly temperature range similar to the range provided during the day will allow the geckos to be more active at night, which is when they prefer to feed and move about.

Night temperatures in a leopard gecko enclosure should be no lower than 68°F (20°C). If you are using a ceramic heat emitter or heating pad for your gecko enclosure, it should be left on. This will allow the geckos to have an end of the enclosure that is warmer than the other, just as they would during the day. An idea is to purchase a heating pad, as to keep one side side of the cage warm. The light should also be placed on this side of the cage.

Temperature monitoring

It is crucial that you monitor your leopard gecko's enclosure. This can be done with the use of a digital thermometer; the use of two thermometers is recommended so that each end of the enclosure can be monitored. It is more economical to purchase a single digital

thermometer with an external probe to monitor the temperatures. The "base" of the thermostat can be placed on the warm end of the enclosure and the "probe" can be placed on the cool end. This will allow you to monitor both ends of the enclosure off a single unit. Many pet stores sell small round dial thermometer for use in reptile enclosures, but these are sometimes inaccurate. Strip thermometers that are used in fish tanks cannot be used either because they are designed to measure the temperature of the air around them, whereas the probe measures the temperature of the substrate, which is more important.

Lighting

Leopard geckos are nocturnal. This means that they are more active during the evening hours and darkness than during the daytime. This also means that they do not require the expensive UV lighting that iguanas and other diurnal reptiles do. A red lightbulb can be used to view the leopard gecko at night without disturbing it as their eyes cannot see this color. Leopard geckos require an average of 12 hours as a photoperiod. Commercial light-timers can be used to achieve this lighting schedule.

Captive Breeding

Leopard Geckos become sexually mature at around 15-30 months of age. In order to produce healthy hatchlings, females are best at a weight of 45 grams. Males however do not need to be of any specific weight once sexual maturity is reached (though an obese male may be reluctant to mate).

Leopard Geckos usually breed from around March to September, though it may begin as early as january and finish as late October. They are also influenced to reproduce by subtle drops in temperature during winter.

If upon inspection of the translucent abdominal skin on a female there is the visual appearance of developing eggs, the female should mate immediately when introduced to a male. Two matings should be allowed to take place in order to insure that successful fertilisation has occured.

When a male and female are introduced, the male begins to beat his tail against the ground producing a thumping noise. In response, the female silently sways her tail from side to side along the ground. Following this, the male will lick her to to obtain her sent, then begin gently biting her from the lower body upwards. If the female does not wish to mate, she will bite back and the male will cease his activity. If she accepts, he will continue up to her neck, making his body parallel to hers and placing his hind leg over her tail, and inserting one of his hemipenes.

Roughly a month later, the female will lay either one or two eggs. Clutches of two eggs will then be laid monthly throughout the rest of the mating season, though this varies from female to female according to age, with older females laying less.

Egg Incubation

Leopard geckos are temperature sexed. During the incubation stage an egg incubated at 79-83 degrees Fahrenheit (26-28°C) will yield a female where an egg incubated at 84-90 degrees Fahrenheit (29-32° C) will typically yield a male. Eggs incubated at too low of a temperature, below 79 degrees Fahrenheit (26° C), will yield sterile, underdeveloped mutated babies which will eventually die due to poor development. It is also important to keep the eggs in a moist environment and water-retaining soil, such as vermiculite.

Helodermas

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Suborder: Lacertilia
Family: Helodermatidae
Genus: ***Heloderma,*** Wiegmann, 1829

Heloderma is a genus of venomous lizards native to the southwestern United States, Mexico and as far south as Guatemala. It consists of two separate species, with six subspecies. They prefer semi-arid habitats.

Taxonomy

Genus *Heloderma*

- *Heloderma horridum*, Beaded lizard
  - Heloderma horridum horridum (Wiegmann, 1829)
    Heloderma horridum alvarezi (Bogert & Martên del Campo, 1956)
    Heloderma horridum exasperatum (Bogert & Martên Del Campo, 1956)
    Heloderma horridum charlesbogerti (Campbell & Vannini, 1988)
- *Heloderma suspectum*, Gila monster
  - Heloderma suspectum cinctum (Bogert & Martên Del Campo, 1956)
    Heloderma suspectum suspectum (Cope, 1869)

In captivity

H. h. horridum, *H. h. exasperatum*, and both subspecies of *H. suspectum* are frequently found in captivity, and often captive bred for the exotic animal trade, and they can command high prices. They are well represented in zoos throughout much of the world. The other two subspecies of *H. horridum* are extremely rare, and only a few captive specimens are known.

Iguanas

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Suborder: Sauria
Family: **Iguanidae**
Genera

Amblyrhynchus
Brachylophus
Conolophus
Ctenosaura
Cyclura
Dipsosaurus
Iguana
Sauromalus

Frost et al. (1989) redefined this family. The genera belonging to the different subfamilies were assigned to separate families. This view is not generally accepted.

Frost et al classification of iguanas

Family Iguanidae

- Genus Amblyrhynchus
  Genus Brachylophus
  Genus Conolophus
  Genus Ctenosaura
  Genus Cyclura
  Genus Dipsosaurus
  Genus Iguana
  Genus Sauromalus
  Genus Armandisaurus (extinct)
  Genus Lapitiguana (extinct)
  Genus Pumila (extinct)

Traditional classification

Family Iguanidae

- Subfamily Corytophaninae: casquehead lizards
  Subfamily Crotaphytinae: collared and leopard lizards
  Subfamily Hoplocercinae: wood lizards, clubtails
  Subfamily Iguaninae: iguanas and spinytail iguanas
  Subfamily Leiocephalinae
  Subfamily Leiosaurinae
  Subfamily Liolaeminae
  Subfamily Oplurinae: Madagascar iguanids
  Subfamily Phrynosomatinae: earless, spiny, tree, side-blotched and horned lizards
  Subfamily Polychrotinae: anoles
  Subfamily Tropidurinae: neotropical ground lizards

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2. **Frost, D.R., R. Etheridge, D. Janies and T.A. Titus** (2001) *Total evidence, sequence alignment, evolution of Polychrotid lizards, and a reclassification of the Iguania (Squamata: Iguania)*. American Museum Novitates 3343: 38 pp.

Iguana | Lesser Antillean Iguana

Iguana

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Suborder: Iguania
Family: Iguanidae
Genus: ***Iguana,*** Laurenti, 1768
Species
Lesser Antillean Iguana, I. delicatissima
Green Iguana, I. iguana

Although **iguana** can refer to other members of the lizard family Iguanidae, this article concerns members of the genus *Iguana*. For information on other genera, see Iguanas. For an article on the information on the species of iguana most commonly kept as pets.

Several species of this genus are common as pets, especially the Green Iguana in the United States and Canada, which can easily grow to six feet long, even in captivity. When treated well they can be docile, affectionate, litterbox trainable, and even walked on a leash. Such pets are either crèche-raised, or harvested from the wild in Mexico. The average life span of a well-cared-for of pet iguana is usually 20 years.

Captured iguanas kept as pets tend to be thin and nervous, often dying from side-effects of the stress of adapting to captivity - though if they're given a large swimming area in which to hide, their chances of survival improve, as they live on stream banks in the wild, diving in when alarmed or for other reasons. As they are cold-blooded creatures, they thrive in humid climates. The Green Iguana needs to be in temperatures of 75 to 90 °F (23 to 32 °C). If it is not kept under UVB lighting it can develop metabolic bone disease.

Iguanas can be considered as an invasive species, along the gulf coast of Florida, especially on Gasparilla Island (where there is an estimated population of over 12000). They commonly hide in the attics of houses, destroy gardens, and in beaches. As an introduced species, they contribute to natural habitat loss, spread salmonella, and could be responsible for the recent decline of the gopher tortoise. This is due to a combination of escaped and intentionally released iguanas which have survived and then thrived in their new habitat.

Contents

Feeding

Iguanas are omnivores, which means they eat plants and meat, though usually tending to eat plants, mainly leaves and fruits. Sometimes iguanas (especially younger ones) will eat eggs, insects and other smaller vertebrae.

Habitat

Iguanas live in the neotropical rainforest, usually at lower altitudes near a water source (lake, river). They spend most of their time in the higher forest canopy, 15 meters (40-50 feet) above ground.

Species of Iguana

(after Frost *et al.*)

- Lesser Antillean Iguana, Iguana delicatissima
  Green Iguana, Iguana iguana
  Amblyrhynchus cristatus, "Marine Iguana"
  Blue Iguana Cyclura lewisi

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- **Frost, D.R., R. Etheridge, D. Janies and T.A. Titus** (2001) *Total evidence, sequence alignment, evolution of Polychrotid lizards, and a reclassification of the Iguania (Squamata: Iguania)*. American Museum Novitates 3343: 38 pp.

Lesser Antillean Iguana

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Family: Iguanidae
Genus: *Iguana*
Species: ***I. delicatissima***
Binomial name: ***Iguana delicatissima,*** Laurenti, 1768

The **Lesser Antillean Iguana** (*Iguana delicatissima*) is one of the species of the genus *Iguana*. Though belonging to the same genus as the Green Iguana, the Lesser Antilles Iguanas has a more blocky, shortened face than the Green Iguana and lacks the distinctive stripe pattern present along the Green Iguana's tail.

Legless lizards

Pygopodidae

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Lacertilia
Infraorder: Gekkota
Family: Pygopodidae

Classification

Family Pygopodidae

- **Subfamily Pygopodinae**
  - Genus Paradelma
    Genus Pygopus
    Genus Delma

- **Subfamily Lialisinae**
  - Tribus Lialisini
    - Genus Lialis
  - Tribus Aprasiaini
    - Subtribus Pletholaxini
      - Genus Pletholax
    - Subtribus Aprasiaini
      - Genus Ophidiocephalus
        Genus Aprasia

Leiosaurids

Leiosauridae

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Suborder: Sauria
Family: **Leiosauridae**
Family Leiosauridae

- Genus Diplolaemus
  Genus Leiosaurus
  Genus Pristidactylus

List of Lacertilia families | Agamas | Anguids | Anoles | Blind lizards | Chameleons | Collared lizards | Corytophanids | Geckos | Helodermas | Iguanas | Legless lizards | Leiosaurids | Liolaemids | Monitor lizards | Mosasaurs | Night lizards | Oplurids | Plated lizards | Phrynosomatids | Skinks | Spectacled lizards | Tropidurids | Spinytail lizards | Wall lizards | Whiptail lizards | Wood lizards | Xenosaurids
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Liolaemids

Liolaemidae

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Suborder: Sauria
Family: **Liolaemidae**

Family Liolaemidae

- Genus Ctenoblepharys
  Genus Liolaemus
  Genus Phymaturus

List of Lacertilia families | Agamas | Anguids | Anoles | Blind lizards | Chameleons | Collared lizards | Corytophanids | Geckos | Helodermas | Iguanas | Legless lizards | Leiosaurids | Liolaemids | Monitor lizards | Mosasaurs | Night lizards | Oplurids | Plated lizards | Phrynosomatids | Skinks | Spectacled lizards | Tropidurids | Spinytail lizards | Wall lizards | Whiptail lizards | Wood lizards | Xenosaurids

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Monitor lizards

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Suborder: Sauria
Family: **Varanidae**
Genus: ***Varanus,*** Merrem, 1820
Species: Many, see text.

Monitor lizards are the family **Varanidae**, a group of lizards which includes the largest living lizard, the Komodo Dragon. **Varanidae** contains only a single genus: ***Varanus***.

In Australia monitor lizards are known as goannas (See main article).

Contents

Evolutionary overview

Monitor lizards are considered to be the most highly developed lizards, possessing a relatively rapid metabolism for reptiles, several sensory adaptations that benefit the hunting of live prey, and a lower jaw that may be unhinged to facilitate eating large prey animals. Recent work indicates that the Varanid lizards, including the Komodo dragon, are indeed venomous and do not produce strains of deadly bacteria as previously thought. However, instead of injecting the venom into prey from fangs like most of their snake cousins do, the venom stays around the base of the teeth.

Origin of Name

It has been said that the name of monitor lizards is derived from a superstition that the creatures would give a warning about the presence of crocodiles. However, this explanation may be apocryphal. According to Wildwatch, the name actually resulted from a mishearing of the Arabic word oaran (lizard) as the German warnen (to warn), which was subsequently Latinized into *monitor*.

Classification

Genus Varanus

- *Varanus acanthurus:* Spiny-tailed goanna or Ridge-tailed monitor
  - *Varanus acanthurus acanthurus interestus* or ???
  - *Varanus acanthurus brachyurus* or ???
  - *Varanus acanthurus insulanicus* or ???
- *Varanus albigularis* or White-throated monitor
  - Varanus albigularis albigularis
    Varanus albigularis angolensis
    Varanus albigularis ionidesi or Black-throated Monitor
- Varanus auffenbergi Peacock monitor
  Varanus baritji Northern ridge-tailed goanna
  Varanus beccarii Black tree monitor
  Varanus bengalensis Bengal monitor
  Varanus bogerti Louisiade tree monitor
  Varanus brevicauda Short-tailed monitor
  Varanus bushi
  Varanus caerulivirens Blue pin-spot monitor
  Varanus caudolineatus Stripe-tailed goanna
  Varanus cerambonensis Ceram mangrove monitor
  Varanus doreanus Blue-tailed monitor
  Varanus dumerilii Dumeril monitor aka Brown Rough Neck Monitor
  Varanus eremius Desert pygmy monitor
  Varanus exanthematicus: Savannah monitor
  Varanus finschi Finsch's monitor
  Varanus flavescens: Yellow mangrove monitor
  Varanus giganteus: the Perentie
  Varanus gilleni Pygmy mulga goanna
  Varanus glauerti Kimberley rock monitor
  Varanus glebopalma Black-palmed rock monitor
  Varanus gouldii Sand goanna (also Gould's goanna, or Ground goanna)
  Varanus griseus Desert monitor
  Varanus indicus Mangrove monitor
  Varanus jobiensis Peach-throat monitor
  Varanus juxtindicus Hakoi
  Varanus keithhornei Canopy goanna
  Varanus kingorum King's goanna
  Varanus komodoensis: Komodo dragon
  Varanus mabitang Panay monitor
  Varanus macraei Blue tree monitor

Varanus melinus Quince monitor
Varanus mertensi: Mertens' water monitor
Varanus mitchelli Mitchell's water monitor
Varanus nebulosus Clouded monitor
Varanus niloticus: Nile monitor
Varanus olivaceus Gray's monitor, Butaan
Varanus ornatus Ornate monitor
Varanus panoptes Argus monitor, Yellow-spotted goanna, Floodplain goanna
Varanus pilbarensis Pilbara rock monitor
Varanus prasinus: Emerald tree monitor

- Emerald tree monitor (also called Green tree monitor) lizard *Varanus prasinus*
- Varanus primordius Blunt-spined goanna

Varanus prisca: Megalania (extinct)
Varanus rosenbergi Rosenberg's goanna
Varanus rudicollis: Black Roughneck monitor
Varanus salvadorii: Crocodile monitor, Artrelia
Varanus salvator: Water monitor
Varanus scalaris Spotted tree goanna
Varanus semiremex Mangrove pygmy goanna
Varanus spenceri Spencer's goanna
Varanus spinulosus St. Isabel mangrove monitor
Varanus storri Storr's goanna
Varanus telenesetes Lia (Biri), Rossel Island tree monitor
Varanus timorensis: Timor tree monitor or Timor monitor
Varanus tristis Black-headed tree goanna
Varanus varius: Lace monitor
Varanus yemenensis Yemen monitor
Varanus yuwonoi Tricolor monitor

Trivia

The movie monster *Varan* takes its name from this genus.

In a season 4 episode of Hey Arnold, the character Helga owned a monitor lizard.

Mosasaurs

Mosasaurinae
Conservation status: Fossil

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Family: Mosasauridae
Subfamily: **Mosasaurinae**

Mosasaurinae (Gervais, 1853; Williston, 1897) is a subfamily of mosasaurs, a diverse group of Late Cretaceous marine squamates.

Russell (1967, pp. 123-124) defined the Mosasurinae as differing from all other mosasaurs as follows: "Small rostrum present or absent anterior to premaxillary teeth. Fourteen or more teeth present in dentary and maxilla. Cranial nerves X, XI, and XII leave lateral wall of opisthotic through two foramina. No canal or groove in floor of basioccipital or basisphenoid for basilar artery. Suprastapedial process of quadrate distally expanded. Dorsal edge of surangular thin lamina of bone rising anteriorly to posterior surface of coronoid...At least 31, usually 42-45 presacral vertebrae present. Length of presacral series exceeds that of postsacral, neural spines of posterior caudal vertebrae elongated to form distinct fin. Appendicular elements with smoothly finished articular surfaces, tarsus and carpus well ossified." In his 1997 revision of the phylogeny of the Mosasauroidea, Bell (pp. 293-332) retained the Mosasaurinae as a clade, though he reassigned Russell's tribe Prognathodontini to the Mosasaurinae and recognized a new tribe of mosasaurines, the Globidensini.

Genera referrable to the Mosasaurinae ("mosasaurines") have been found on all continents except Australia and South America. The lineage first appears in the Turonian and thrived until the mass extinction event at the end of the Maastrichtian. They ranged in size from one of the smallest known mosasaurs (Carinodens, 3-3.5 meters), to medium-sized taxa (Clidastes, 6+ meters), to the largest of the mosasaurs (Mosasaurus hoffamanni) reaching lengths in excess of 13 meters. Many genera of mosasaurines were either piscivorous or generalists, preying on fish and other marine reptiles, but one lineage, the Globidensini evolved specialized crushing teeth, adapting to a diet of ammonites and/or marine turtles.

Species and Taxonomy

- Subfamily Mosasaurinae
    - Mosasaurini (Russell, 1967)
        - *Clidastes* (paraphyletic)
            - *C. liodontus*
            - *C. "moorevilensis" (*nomen nudum*)*
            - *C. propython*
        - *Mosasaurus* (paraphyletic)
            - *M. hoffmanni* (=*M. maximus*)
            - *M. conodon*
            - *M. dekayi*
            - *M. missouriensis*
            - *M. mokoroa*
        - *Moanasaurus*
            - *M. mangahouangae*
        - *Amphekepubis*
            - *A. johnsoni*
        - *Liodon* (polyphyletic)
            - *L. anceps*
            - *L. sectorius*
            - *L. mosasauroides*
    - Plotosaurini (Russell, 1967)
        - *Plotosaurus*
            - *P. tuckeri*
            - *P. bennisoni*
    - Globidensini (Bell, 1997)
        - *Globidens*
            - *G. alabamaensis*
            - *G. dakotensis*
        - *Prognathodon*
            - *P. overtoni*
            - *P. giganteus*
            - *P. rapax*
            - *P. waiparaensis*
            - *P. stadtmani*
            - *P. solvayi*
        - *Plesiotylosaurus*
            - *P. crassidens*
- Mosasaurinae *incertae sedis*
    - *Carinodens*
        - *C. belgicus*
    - *Goronyosaurus*

        - *G. nigeriensis*
    - *Pluridens*
        - *P. walkeri*

References

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Halisaurinae | Plioplatecarpinae | Tylosaurinae

Halisaurinae

Conservation status: Fossil

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Family: Mosasauridae
Subfamily: **Halisaurinae,** Bardet et al., 2005
Genera: See text.

Halisaurinae (Bardet et al., 2005) is a subfamily of mosasaurs, a diverse group of Late Cretaceous marine squamates.

Bardet et al. (2005, p. 464) diagnosed the Halsaurinae as all mosasaurs more closely related to *Halisaurus* than *Moanasaurus*. Unambiguous character states were listed as follows: "premaxilla-maxilla sutural contact vertical anteriorly, oblique at midpoint and horizontal posteriorly; contact plane between the parietal and the supratemporal oblique; preaxial ridge extending on two-thirds of the length of the radius; tibia and fibula long and slender with slightly expanded extremities. Ambiguous characters include "dorsal median ridge borne on the anterior two-thirds of the frontal; frontal with ventral boss; parietal foramen surrounded by a ventral boss; quadrate with large infrastapedial process; coalescent infra- and suprastapedial processes of quadrate; zygosphene-zygantrum complex absent; synapophyses of the cervical vertebrae extending ventrally to the ventral surface of the centrum; fused haemal spines."

Designation of this subfamily followed many decades of confusion surrounding the type genus, Halisaurus, especially H. sternbergii, a species from the Mooreville Chalk of Alabama and the Niobrara Chalk of Kansas. Originally, the species had been referred to the mosasaurine Clidastes (Wiman, 1920), then to Halisaurus (Russell, 1967; p. 369), which was also considered a member of the Mosasaurinae at that time. Later workers (Wright, 1988; Bell, 1997, etc.) questioned the phylogenetic position and monophyly of Halisaurus, in part because of striking morphological differences between H. sternbergii and the other known species of the taxon. Finally, Bardet et al. (2004) determined that H. sternbergii was not conspecific with the other members of the genus and erected a new genus, Eonatator, as well a new new subfamily, consisting of Eonatator and Halisaurus. Halisaurines (as members of this subfamily are collectively and informally known) were small to medium-sized mosasaurs averaging 4.5-6+ meters in length. Of all known mosasaurids, they were the

least adapted to a marine lifestyle. Halisaurines are known from North America, Europe, South America, and Africa. The earliest known remains of halisaurines occur in rocks of Santonian age and the subfamily persists until the latest Maastrichtian. The etymology of this group derives from the genus Halisaurus (Greek halis = "sea" + Greek *sauros* = "lizard").

Phylogeny and Taxonomy

Halisaurus is an important taxon in studies of mosasaur phylogeny as it has been repeatedly considered the sister group to all other mosasaurs. A cladistic analysis by Bardet et al. (2004, p. 462-463) supported this model and the monophyletic clade composed of Halisaurus and Eonatator was christened the Halisaurinae, "the sister group of more advanced mosasaurids."

- Halisaurinae
  - *Halisaurus*
    - *H. platyspondylus*
    - *H. ortlebi*
    - *H. arambourgi*
    - *H. onchognathus* (nomen dubium; holotype destroyed during WWII)
  - *Eonatator*
    - *E. sternbergii*

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Plioplatecarpinae

Conservation status: Fossil

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Family: Mosasauridae
Subfamily: **Plioplatecarpinae,** Dollo, 1884; Williston, 1897
Genera; See text.

Plioplatecarpinae (Dollo, 1884; Williston, 1897) is a subfamily of mosasaurs, a diverse group of Late Cretaceous marine squamates.

Russell (1967, pp. 148) defined the Plioplatecarpinae as follows: Small rostrum present or absent anterior to premaxillary teeth. Cranial nerves X, XI, XII leave lateral wall of opisthotic through single foramen. Canal or deep groove in floor of basioccipital and basispehnoid for basilar artery. Suprastapedial process of quadrate large, bluntly terminated and with parallel sides. Dorsal edge of surangular rounded and longitudinally horizontal...Twenty-nine or less presacral vertebrae present. Length of presacral series less than that of postsacral, neural spines of posterior caudal vertebrae at most only slightly elongated, do not form an appreciable fin. Haemal arches usually unfused to caudal centra. Appendicular elements lack smoothly finished articular surfaces."

Genera referrable to the Plioplatecarpinae (informally and collectively known as "plioplatecarpines") have been found on all continents, though the occurrences in Australia remain questionable. The etymology of the subfamily is derived from one of its members, Plioplatecarpus: Greek pleion = "more" + Greek plate = "oar" + Greek karpos = "wrist, carpus"). In general, plioplatecarpines were short-skulled, short-bodied forms and were among the strongest swimming mosasaurs. Some workers have likened them to pinnipeds in their agility. Most forms were likely piscivores ("fish eaters"), though cephalopods (belemnites) evidently formed an important part of the plioplatecarpine diet. Larger forms may have also fed upon smaller marine reptiles. At least one genus evolved sturdy crushing teeth adapted to feeding on shellfish. The plioplatecarpines were medium-sized mosasaursm ranging from 12-25 feet ion length. Russell (1967) included two tribes, the Plioplatecarpini and Prognathodontini, the latter of which has been reassigned by Bell (1997) to the Mosasaurinae.

Polcyn and Bell (2005, p. 322) have erected a more inclusive

clade, the parafamily Russellosaurina, which includes the "subfamilies Tylosaurinae and Plioplatecarpini and their sister-clade containing the genera Tethysaurus, Russellosaurus, and *Yaguarasaurus*."

The first plioplatecarpines appear in the Turonian and are among the oldest of mosasaurs, and the clade persists throughout the Maastrichtian, a period of approximately 24 million years.

Species and Taxonomy

- Plioplatecarpinae
    - Plioplatecarpini
        - *Platecarpus* (paraphyletic)
            - *P. tympaniticus* (=*P. coryphaeus*, *P. ictericus*; Kiernan 2002)
            - *P. planifrons*
            - *P. bocagei* (=*Angolasaurus*; Lingham-Solair 1994)
        - *Ectenosaurus*
            - *E. clidastoides*
        - *Selmasaurus*
            - *S. russelli*
        - *Igdamanosaurus*
            - *I. aegyptiacus*
        - *Yaguarasaurus*
            - *Y. colombianus*
        - *Plioplatecarpus*
            - *P. primaevus*
            - *P. houzeaui*
            - *P. marshii*

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Tylosaurinae

Conservation status: Fossil

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Family: Mosasauridae
Subfamily: **Tylosaurinae,** Williston, 1895
Genera: See text.

Tylosaurinae (Williston, 1895; Williston, 1897) is a subfamily of mosasaurs, a diverse group of Late Cretaceous marine squamates.

Russell (1967, pp. 170) defined the Tylosaurinae as follows: "Large rostrum present anterior to premaxillary teeth. Twelve or more teeth in dentary and maxilla. Cranial nerves X, XI, and XII leave lateral wall of opisthotic through a single foramen. No canal in basioccipital or basispehnoid for basilar artery. Suprastapedial process of quadrate moderately large, distally pointed. Dorsal edge of surangular rounded and longitudinally horizontal...Twenty nine presacral vertebrae present. Length of presacral series less than that of postsacral series in Tylosaurus, neural spines of posterior caudal vertebrae at most only slightly elongated, do not form an appreciable fin. Haemal arches unfused to caudal centra. Appendicular elements lack smoothly finished articular surfaces."

Genera referrable to the Tylosaurinae (informally and collectively known as "tylosaurines" or "tylosaurs") have been found on all continents except Australia and South America. The etymology for the subfamily is dervied from the type species, Tylosaurus. In general, tylosaurs were large-bodied marine lizards armed with sturdy teeth and a "battering ram" snout composed of the elongated premaxilla and dentaries. Stomach contents from a tylosaur recovered in South Dakota (Martin et Bjork, 1987) included remains of other mosasaurs, bony fish, the large seabird Hesperornis, and sharks, indicating that tylosaurs were generalists. Lingham-Soliar (1992) suggested that tylosaurines were not among the fastest swimming nor the strongest mosasaurids. However, they are lightly built, having greatly reduced the weight of their bodies and possessing relatively small pectoral and pelvic girdles, fore- and hindlimbs. Their bone is highly cancellous and may have been impregated with fat cells during life, adding buoyancy. These traits suggest that tylosaurs may have been ambush predators. Tylosaurs were among the largest mosasaurs, with some species of Tylosaurus and Hainosaurus reaching lengths of 9-15+

meters, making them among the largest of all marine reptiles. A small species of *Tylosaurus* reported by Russell (1967), *T. "zangerli"* has since proven to be a juvenile individual of *T. proriger* (Kiernan, 2002).

Polcyn and Bell (2005, p. 322) have erected a more inclusive clade, the parafamily Russellosaurina, which includes the "subfamilies Tylosaurinae and Plioplatecarpinae and their sister-clade containing the genera Tethysaurus, Russellosaurus, and *Yaguarasaurus*."

Tylosaurs first appear in the fossil record in the Coniacian and persist well into the Maastrichtian, a period of approximately twenty million years.

Species and Taxonomy

- Tylosaurinae
    - *Tylosaurus* (?paraphyletic)
        - *T. proriger*
        - *T. nepaeolicus*
        - *T. kansasensis*
        - *T. ivoensis*
    - *Hainosaurus*
        - *H. bernardi*
        - *H. pembinensis*
        - *H. gaudryi*
    - *Taniwhasaurus*
        - *T. oweni* (=*Tylosaurus haumuriensis*)
    - *Lakumasaurus*
        - *L. antarcticus*

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Night lizards

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Sauria
Family: **Xantusiidae**
Subfamilies: See text.

Night lizards (family name Xantusiidae) are a group of very small, viviparous (live-bearing) lizards, averaging from less than 4 cm to over 12 cm long. It has only three genera, with approximately 23 living species. The genera are divided by geographic range: Xantusia in southwestern North America and Baja California, Cricosaura in Cuba, and Lepidophyma, the most populous night lizard genus, in Central America.

Night lizards were originally mistaken to be nocturnal because of their secretive lifestyle, but they are in fact strictly diurnal. Physically, night lizards are characterized by relatively flat bodies and heads. Their heads are covered by large, smooth plates, while their bodies have rougher, granular skin. Their eyes, like those of snakes, are covered by immoveable, transparent membranes that function as eyelids. They feed on insects and sometimes plants.

Contrary to the reproductive strategies of most small lizards, night lizards tend to have very low reproductive rates, with several species giving birth to only one or two offspring. They generally take several years to reach sexual maturity. However, the very limited lifestyle of night lizards has contributed to a high life expectancy. Night lizards have evolved to live in very narrow environmental niches —"microhabitat specialization"—such as rock crevices or damp logs, and may spend their entire life under the same cover.

Classification

Family Xantusiidae

- **Subfamily Cricosaurinae**
  - Genus Cricosaura
- **Subfamily Xantusiinae**
  - Genus Lepidophyma
  - Genus Xantusia

Oplurids

Opluridae

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Suborder: Sauria
Family: **Opluridae**

Classification

Family Opluridae

- Genus Chalarodon
- Genus Oplurus

Plated lizards

Gerrhosauridae

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Sauria
Family: **Gerrhosauridae**

Classification

Family Gerrhosauridae

- **Subfamily Gerrhosaurinae**
  - Genus Angolosaurus
    Genus Cordylosaurus
    Genus Gerrhosaurus
    Genus Tetradactylus
- **Subfamily Zonosaurinae**
  - Genus Tracheloptychus
    Genus Zonosaurus

Phrynosomatids

Phrynosomatidae

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Suborder: Sauria
Family: **Phrynosomatidae**
Genera
Callisaurus
Cophosaurus
Holbrookia
Petrosaurus
Phrynosoma
Sator
Sceloporus
Uma
Urosaurus
Uta

Phrynosomatidae is a family of lizards.

Genera

- Zebra-tailed lizards, Callisaurus
  Greater earless lizard, Cophosaurus
  Earless lizards, Holbrookia
  California rock lizards, Petrosaurus
  Horned lizards, Phrynosoma
  Sators, Sator
  Spiny lizards, Sceloporus
  Fringe-toed lizards, Uma
  Tree and brush lizards, Urosaurus
  Side-blotched lizards, Uta

Skinks

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Sauria
Family: **Scincidae,** Gray, 1825
Genera: many—see text

Skinks are the most diverse group of lizards. They make up the family **Scincidae** which shares the superfamily or infraorder Scincomorpha with several other lizard families, including Lacertidae (the "true" or wall lizards). **Scincidae** is the largest of the lizard families with about 1,200 species.

Contents

Description

Skinks look roughly like true lizards, but most species have no pronounced neck and relatively small legs. Several genera (e.g., Typhlosaurus) have no limbs at all, others, such as Neoseps, have only reduced limbs. Often, their way of moving resembles that of snakes more than that of other lizards. Skinks usually have long, tapering tails that can be shed and regenerated.

Most skinks are medium sized with a maximum length from the snout to the vent of some 12 cm, although there are a few that grow to larger sizes, such as the Corucia, which can reach 35 cm from snout to vent.

Diet

Skinks are generally carnivorous and largely eat insects, including crickets, grasshoppers, beetles, and caterpillars. They also eat spiders, earthworms, snails, slugs, isopods, other lizards, and small mice. Some species, particularly those favored as home pets, have a more varied diet and can be maintained on a regimen of roughly 60% vegetables/leaves/fruit and 40% meat and meat products (cat or dog food). [1]

Habitat

Skinks occur worldwide. Some species are endangered.

Many species are good burrowers. There are more terrestrial or fossorial (burying) species than arboreal (tree-climbing) or aquatic species. Some are "sand swimmers", especially the desert species, such as the Mole skink in Florida. Most skinks are diurnal, so they are active during the day. They like to crawl out on rocks or logs to bask (soak up heat from the sun) during the day.

Breeding

During the breeding season, some types of skink will exhibit orange or red markings to indicate sexual maturity. About 55% of the skinks are oviparous, that is, they lay eggs in small clutches. The other 45% are ovoviviparous, giving birth to living offspring.

Predators

Raccoons, red foxes, opossums, snakes and hawks all prey on skinks.

Classification

Many large genera, Mabuya for example, are still insufficiently studied, and systematics is at times controversial, see e.g. the taxonomy of the Western Skink (*Eumeces skiltonianus*).

Family Scincidae

- Genus Ablepharus
  Genus Acontias
  Genus Acontophiops
  Genus Afroablepharus
  Genus Amphiglossus
  Genus Androngo
  Genus Anomalopus
  Genus Apterygodon
  Genus Asymblepharus
  Genus Ateuchosaurus
  Genus Barkudia
  Genus Bartleia
  Genus Bassiana
  Genus Brachymeles
  Genus Caledoniscincus
  Genus Calyptotis
  Genus Carlia
  Genus Cautula
  Genus Chabanaudia
  Genus Chalcides
  Genus Chalcidoseps
  Genus Coeranoscincus
  Genus Cophoscincopus
  Genus Corucia
  Genus Cryptoblepharus
  Genus Cryptoscincus
  Genus Ctenotus
  Genus Cyclodina
  Genus Cyclodomorphus
  Genus Dasia
  Genus Davewakeum
  Genus Egernia
  Genus Emoia
  Genus Eremiascincus
  Genus Eroticoscincus
  Genus Eugongylus
  Genus Eulamprus

Genus Eumeces
Genus Eumecia
Genus Euprepes
Genus Eurylepis
Genus Feylinia
Genus Fojia
Genus Geomyersia
Genus Geoscincus
Genus Glaphyromorphus
Genus Gnypetoscincus
Genus Gongylomorphus
Genus Gongylus
Genus Graciliscincus
Genus Haackgreerius
Genus Hemiergis: Earless Skinks (Australia)
Genus Hemisphaeriodon
Genus Isopachys
Genus Janetaescincus
Genus Lacertaspis
Genus Lacertoides
Genus Lacertus
Genus Lamprolepis
Genus Lampropholis; (Common Garden Skink)
Genus Lankascincus
Genus Larutia
Genus Leiolopisma
Genus Leptoseps
Genus Leptosiaphos
Genus Lerista
Genus Lioscincus
Genus Lipinia
Genus Lobulia
Genus Lubuya
Genus Lygisaurus
Genus Lygosoma
Genus Mabuya
Genus Macroscincus
Genus Marmorosphax
Genus Melanoseps
Genus Menetia
Genus Mesoscincus
Genus Mochlus
Genus Morethia
Genus Nangura

Genus Nannoscincus
Genus Neoseps
Genus Nessia
Genus Niveoscincus
Genus Notoscincus
Genus Novoeumeces
Genus Oligosoma
Genus Ophiomorus
Genus Ophioscincus
Genus Pamelaescincus
Genus Panaspis
Genus Papuascincus
Genus Parachalcides
Genus Paracontias
Genus Paralipinia
Genus Parvoscincus
Genus Phoboscincus
Genus Plestiodon
Genus Prasinohaema
Genus Proablepharus
Genus Proscelotes
Genus Pseudoacontias
Genus Pseudemoia
Genus Pygomeles
Genus Riopa
Genus Ristella
Genus Saiphos
Genus Saproscincus
Genus Scelotes
Genus Scincella
Genus Scincopus
Genus Scincus
Genus Scolecoseps
Genus Sepsina
Genus Sigaloseps
Genus Simiscincus
Genus Sphenomorphus
Genus Sphenops
Genus Tachygia
Genus Tiliqua; (Blue-tongued lizards)
Genus Trachydosaurus; the rugosus species is known as Shingle
Genus Tribolonotus
Genus Tropidophorus
Genus Tropidoscincus

Genus Typhlacontias
Genus Typhlosaurus
Genus Voeltzkowia

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1. ^ McLeod, Lianne. Keeping Blue Tongued Skinks as Pets. Retrieved on 2006-08-27.

Spectacled lizards

Gymnophthalmidae

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Sauria
Family: **Gymnophthalmidae**

Gymnophthalmidae is a family of lizards, sometimes known as **spectacled lizards** or **microteiids**.

They are called 'spectacled' because of their transparent lower eyelids, so they can still see with closed eyes. The eyelids are not fixed, like most geckos and all snakes. These lizards live in a wide variety of habitats, from desert to mountain to rain forest, throughout Central America and South America. Spectacled lizards are related with the Teiidae, but they look like skinks; reduced limbs and smooth scales, some species have no limbs at all. They eat mostly insects and other invertebrates, all species are oviparous.

Classification

Family Gymnophthalmidae

- Genus Alopoglossus
  Genus Amapasaurus
  Genus Anadia
  Genus Anotosaura
  Genus Argalia
  Genus Arthrosaura
  Genus Aspidolaemus
  Genus Arthroseps
  Genus Bachia
  Genus Calyptommatus
  Genus Cercosaura
  Genus Colobodactylus
  Genus Colobosaura
  Genus Colobosauroides
  Genus Echinosaura
  Genus Ecpleopus
  Genus Euspondylus
  Genus Gymnophthalmus
  Genus Heterodactylus
  Genus Iphisa
  Genus Leposoma
  Genus Macropholidus
  Genus Micrablepharus
  Genus Neusticurus
  Genus Nothobachia
  Genus Ophiognomon
  Genus Opipeuter
  Genus Pantodactylus
  Genus Pholidobolus
  Genus Placosoma
  Genus Prionodactylus
  Genus Procellosaurinus
  Genus Proctoporus
  Genus Psilophthalmus
  Genus Ptychoglossus
  Genus Riolama
  Genus Stenolepis
  Genus Teuchocercus
  Genus Tretioscincus
  Genus Vanzosaura

Tropidurids

Tropiduridae

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Sauria
Family: **Tropiduridae**
Family Tropiduridae

- Genus Microlophus
  Genus Plesiomicrolophus
  Genus Plica
  Genus Tropidurus
  Genus Uracentron
  Genus Uranoscodon

Spinytail lizards

Cordylidae

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Family: **Cordylidae**
Commonly known as the Spinytail lizards

Classification

Family Cordylidae

- **Subfamily Chamaesaurinae**
  - Genus Chamaesaura
- **Subfamily Cordylinae**
  - Genus Cordylus
    Genus Platysaurus
    Genus Pseudocordylus

List of Lacertilia families | Agamas | Anguids | Anoles | Blind lizards | Chameleons | Collared lizards | Corytophanids | Geckos | Helodermas | Iguanas | Legless lizards | Leiosaurids | Liolaemids | Monitor lizards | Mosasaurs | Night lizards | Oplurids | Plated lizards | Phrynosomatids | Skinks | Spectacled lizards | Tropidurids | Spinytail lizards | Wall lizards | Whiptail lizards | Wood lizards | Xenosaurids

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Wall lizards

Lacertidae

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Sauria
Family: ***Lacertidae***
Genera: Many, see text.

Lacertidae is the family of the **wall lizards**, which are native to Europe, Africa, and Asia, and (in *Lacerta*) include some of the most common types seen in Europe.

Contents

Habitat

All species are terrestrial. European and Mediterranean species live mainly in forest and scrub habitats. Eastward Eremias and Ophisops replace them in the grassland and desert habitats of Asia. African species usually live in rocky, arid areas. Holaspis is one of the few arboreal lacertids, and its single species (Holaspis guentheri) is a glider, although apparently a poor one using its broad tail and flattened body as an aerofoil (Zug et al. 2001).

Size

Small or medium-sized; usually less than 9 cm snout-vent length, but a few species exceed 15 cm SVL (Lacerta lepida).

Food

Primarily insectivorous. Meroles anchietae (formerly Aporosaura anchietae) is one of the few Wall lizards that regularly eats seeds, not an unlikely food for a lizard of the harsh Namib Desert.

Reproduction

At least 8 species of Lacerta are parthenogenetic and all are oviparous except for some populations of Lacerta vivipara.

Identification

The Common Wall Lizard is a small, thin lizard whose small scales are highly variable in color and pattern. Their coloration is generally brownish or grayish, and may occasionally be tinged with green. In some individuals the row of spots along their back may form a line, while others may have a reticulated pattern with dark spots on the side and scattered white spots that can be blue in the shoulder region. The tail is brown, grey or rust in color, and may also have light bars on the sides. The belly region has 6 rows of larger rectangular scales that are generally reddish, pink, or orangish. Common Wall Lizards may also have dark markings on the throat.

Distribution and Status

The Common Wall Lizard is an introduced species whose natural range spans mainland Europe in central Spain, southern Belgium, and the Netherlands. In the US this lizard has established populations along the Ohio River and within Cincinnati, Ohio, particularly in the vicinity of the Cincinnati Zoo (US distribution map). Within the Midwest/Upper South, the Common Wall Lizard is only found in Ohio and Northern Kentucky.

Ecology

The Common Wall Lizard prefers urban settings where it can scurry between rock, rubble, debris and buildings.

Classification

Family Lacertidae

- **Subfamily Gallotiinae**
  - Genus Gallotia
    Genus Psammodromus

- **Subfamily Lacertinae**
  - Genus Acanthodactylus
    Genus Adolfus
    Genus Algyroides
    Genus Australolacerta
    Genus Darevskia
    Genus Eremias
    Genus Gastropholis
    Genus Holaspis
    Genus Heliobolus
    Genus Iberolacerta
    Genus Ichnotropis
    Genus Lacerta
    Genus Latastia
    Genus Meroles
    Genus Mesalina
    Genus Nucras
    Genus Ophisops
    Genus Pedioplanis
    Genus Philochortus
    Genus Podarcis
    Genus Poromera
    Genus Pseuderemias
    Genus Takydromus
    Genus Timon
    Genus Tropidosaura

Whiptail lizards

Teiidae

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Suborder: Sauria
Family: **Teiidae**
Genera
Ameiva
Aspidoscelis
Callopistes
Cnemidophorus
Crocodilurus
Dicrodon
Dracaena
Kentropyx
Teius
Tupinambis

Teiidae is a family of lizards, generally known as **whiptails**, that includes the parthenogenic genera Cnemidophorus and Aspidoscelis and the non-parthenogenic Tegus.

Morphology

Teiids can be distinguished from other lizards by the following characteristics: they have large rectangular scales that form distinct transverse rows ventrally and generally small granular scales dorsally, they have head scales that are separate from the skull bones, and the teiid teeth are solid at the base and "glued" to the jaw bones.

Sources

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Wood lizards

Hoplocercidae

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Suborder: Sauria
Family: Hoplocercidae

The **hoplocercids** are a family of lizards native to the tropical forests of Central and South America. They are predominantly terrestrial, and some use their spiny tails to dig shallow retreats in the ground, although they do not build true burrows.

Classification

Family Hoplocercidae

- Genus Enyalioides
  Genus Hoplocercus
  Genus Morunasaurus

Xenosaurids

Xenosauridae

Scientific classification

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Sauria
Family: **Xenosauridae**

Classification

Family Xenosauridae

- **Subfamily Shinisaurinae**
    - Genus Shinisaurus
- **Subfamily Xenosaurinae**
    - Genus Xenosaurus

Snakes

Fossil range: Cretaceous - Recent
Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Suborder: **Serpentes,** Linnaeus, 1758
Superfamilies and Families

- Henophidia

- Aniliidae
  Anomochilidae
  Boidae
  Bolyeriidae
  Cylindrophiidae
  Loxocemidae
  Pythonidae
  Tropidophiidae
  Uropeltidae
  Xenopeltidae

  - Typhlopoidea

- Anomalepididae
  Leptotyphlopidae
  Typhlopidae

  - Xenophidia

- Acrochordidae
  Atractaspididae
  Colubridae
  Elapidae
  Hydrophiidae
  Viperidae

Ophidian redirects here. For the collectible card game, see Ophidian 2350.

Snakes (from Old English *snaca*, and ultimately from the Proto-Indo-European base **snag-* or **sneg-*, "to crawl"), also known as ophidians, are cold-blooded legless reptiles closely

related to lizards, which share the order Squamata. There are also several species of legless lizard which superficially resemble snakes, but are not otherwise related to them. A love of snakes is called ophiophilia, a fear of snakes is called ophidiophobia. A specialist in snakes is an ophiologist.

An old synonym for snake is **serpent** (which comes from Old French, and ultimately from *serp-, "to creep"[1]); in modern usage this usually refers to a mythic or symbolic snake, and information about such creatures can be found under serpent (symbolism). This article deals with the biology of snakes.

Contents

Evolution

Recent fossil evidence suggests that snakes directly evolved from burrowing lizards, either varanids or some other group. An early fossil snake, Najash rionegrina, was a two-legged burrowing animal with a sacrum, fully terrestrial. One extant analog of these putative ancestors is the earless monitor Lanthanotus of Borneo, although it also is semi-aquatic. As these ancestors became more subterranean, they lost their limbs and became more Features such as the transparent, fused eyelids and loss of external ears, according to this hypothesis, evolved to combat Modern boas do have vestigal hind limbs, tiny, clawed digits known as anal spurs and used to grasp during mating.

The alternative hypothesis, based on the land much like they are today. Fossil snake remains are known from early Late Cretateous marine sediments, which is consistent with this hypothesis, particularly as they are older than the terrestrial *Najash rionegrina*. Similar skull structure; reduced/absent limbs; and other anatomical features found in both mosasaurs and snakes lead to a positive cladistical correlation, though some features are also shared with varanids. Supposedly similar locomotion for both groups is also used as support for this , and (it has been claimed) therefore not to mosasaurs, the proposed ancestor in the aquatic scenario of their evolution. However, there is more evidence linking]] of mammals following the extinction of the dinosaurs.

Prey

All snakes are carnivorous, eating small animals including lizards and other snakes, rodents and other small mammals, birds, eggs or insects. Some snakes have a venom bite which they use to kill their prey before eating it. Other snakes kill their prey by constriction. Still others swallow their prey whole and alive. Most snakes are very easy to feed in captivity, apart from a minority of species.

Snakes do not chew their food and have a very flexible lower jaw, the two halves of which are not rigidly attached, and numerous other joints in their skull (see snake skull), allowing them to open their mouths wide enough to swallow their prey whole, even if it is larger in diameter than the snake itself. It is a common misconception that snakes actually dislocate their lower jaw to consume large prey.

After eating, snakes become torpid while the process of digestion takes place. Digestion is an intensive activity, especially after the consumption of very large prey. In species which feed only sporadically, the entire intestine enters a reduced state between meals to conserve energy, and the digestive system is 'up-regulated' to full capacity within 48 hours of prey consumption. So much metabolic energy is involved in digestion that in *Crotalus durissus*, the Mexican rattlesnake, an increase of body temperature to as much as 14 degrees Celsius above the surrounding environment has been observed.[2] Because of this, a snake disturbed after having eaten recently will often regurgitate its prey in order to be able to escape the perceived threat. However, when undisturbed, the digestive process is highly efficient, dissolving and absorbing everything but hair and claws, which are excreted along with uric acid waste. Snakes have been known to occasionally die from trying to swallow an animal that is too big. Snake digestive acids are unable to digest most plant matter, which passes through the digestive system mostly untouched.

Snakes do not normally prey on people, but there are instances of small children being eaten by large constrictors in the jungle. While some particularly aggressive species exist, most will not attack humans unless startled or injured, preferring instead to avoid contact. The majority of snakes are either non-venomous or possess venom that is not harmful to humans.

As a general rule, snakes eat rodents. There are exceptions to

this, such as the natal green snake, which eats insects. Snakes generally pick a few food types to specialise in (for example, royal pythons will generally eat mice and gerbils in the wild).

Skin

The skin is covered in scales. Most snakes use specialized belly scales to move, gripping surfaces. The body scales may be smooth, keeled, or granular. Their eyelids are transparent "spectacle" scales which remain permanently closed, called brille. They shed their skin periodically. Unlike other reptiles, this is done in one piece, like pulling off a sock, with the snake rubbing its nose against something rough, like a rock, for instance, creating a rip in the skin around the nose and the mouth until the skin is completely removed.[1] The primary purpose of shedding this is to grow; shedding also removes external parasites. This periodic renewal has led to the snake being a symbol of healing and medicine, as pictured in the Rod of Asclepius. In "advanced" (Caenophidian) snakes, the broad belly scales and rows of dorsal scales correspond to the vertebrae, allowing scientists to count the vertebrae without dissection. If there is not enough humidity in the air while snakes are shedding their skin, it can be very dangerous for the snake, because the dry skin does not shed. Skin that remains attached to the snake can harbour diseases and parasites. A tail tip that is not removed can constrict as the snake grows, cutting off the blood supply to the end of the tail causing it to drop off. A retained spectacle can cause the snake to become blind in the affected eye.

Perception

While snake vision is unremarkable (generally being best in arboreal species and worst in burrowing species), it is able to detect movement. Some snakes, like the Asian vine snake, have binocular vision. In most snakes, the lens moves back and forth within the eyeball to focus. In addition to their eyes, some snakes (pit vipers, pythons, and some boas) have infrared-sensitive receptors in deep grooves between the nostril and eye which allow them to "see" the radiated heat.

Snakes have no external ears, but they do have a bone called the *quadrate* under the skin on either side of the head which focuses sound into the cochlea. Their sense of hearing is most sensitive to frequencies around 200–300 Hz.

A snake smells by using its forked tongue to collect airborne particles then passing them to the Jacobson's organ or the Vomeronasal organ in the mouth for examination. The fork in the tongue gives the snake a sort of directional sense of smell. The part of the body which is in direct contact with the surface of the ground is very sensitive to vibration, thus a snake is able to sense other animals approaching.

Internal organs

The left lung is very small or sometimes even absent, as snakes' tubular bodies require all of their organs to be long and thin. To accommodate them all, only one lung is functional. This lung contains a vascularized anterior portion and a posterior portion which does not function in gas exchange. This 'saccular lung' may be used to adjust buoyancy in some aquatic snakes and its function remains unknown in terrestrial species. Also, many organs that are paired, such as kidneys or reproductive organs, are staggered within the body, with one located ahead of the other. The most primitive snakes, including boas and pythons, have anal spurs, a pair of claws on either side of the cloaca which are used by the males for stimulation of females during coitus.

Locomotion

Snakes utilize a variety of methods of movement which allows them substantial mobility in spite of their legless condition. All snakes are capable of lateral undulation, in which the body is flexed side-to-side, and the flexed areas propagate posteriorly, giving the overall shape of a posteriorly propagating sine wave. In addition, all snakes are capable of concertina movement. This method of movement can be used to both climb trees and move through small tunnels. In the case of trees, the branch is grasped by the posterior portion of the body, while the anterior portion is extended. The anterior portion then grasps the branch, and the posterior portion is pulled forward. In the case of tunnels, instead of grasping, the body loops are pressed against the tunnel walls to attain traction, but the motion is otherwise similar. Another common method of locomotion is rectilinear locomotion, in which the snake remains straight and propels itself via a caterpillar-like motion of its belly-muscles. This mode is usually only used by very large, heavy snakes, such as large pythons and vipers. The most complex and interesting mode is sidewinding, an undulatory motion used to move across slippery mud or loose sand.

Not all snakes dwell on land; sea snakes live in shallow tropical seas.

Studies of the motion and muscle activity of moving snakes have shed light on how each of these modes is achieved.

In terrestrial lateral undulation, posteriorly propagating unilateral waves of muscle contraction occur. The regions of muscle activity for each side extend from the most concave point on that side posteriorly to the most convex side. Thus, when a point on the snake's body is maximally flexed to the right, the right muscles activate, bending it back to the left until it's maximally right-convex, at which point the right side muscles turn off, and the left side muscles turn on. Speed is modulated primarily by alteration of frequency. Aquatic lateral undulation appears superficially similar, but the muscle activation pattern is different, with the regions of muscle activity being 'shifted' posteriorly to where they would be in terrestrial lateral undulation. The reasons for this difference are not fully understood.

Sidewinding, though it appears complex and confusing, is actually a simple modification of terrestrial lateral undulation. At the points of maximal flexion, the dorsalmost muscle group

(traversospinalis group) activates, lifting that portion of the body over the ground, and resulting in other portions of the body remaining in static contact. This mode is used to cross slick surfaces such as mud flats and sand, and has nothing to do with thermoregulation, as is sometimes erroneously stated. Many species of snake, including species commonly kept as pets and which do not usually encounter deserts or mud flats, will sidewind when placed on a slick floor or tabletop and enticed to move fast.

Concertina locomotion and rectilinear locomotion are less well understood. Studies of muscle activity have only been done for tunnel concertina locomotion, which shows that the muscles are unilaterally active in static regions of bending in order to brace the snake against the tunnel walls. Rectilinear is believed to rely on different muscles from the other modes; while they all rely on the large epaxial muscles, rectilinear locomotion seems to rely upon the small costocutaneous muscles. However, this has not been verified experimentally, due to the difficulties in working with these small muscles.

"Flying" snakes

Several species of snake have the ability to glide, all being in the genus Chrysopelea. They are quite capable at it, able to travel as far as 13.7 metres through the air. They tend to make slithering motions to steer and help propel themselves along, propulsion being something unusual among the many gliding animals. This has contributed, in ancient times, to the belief in Wyrms (Legless, snake-like dragons that could supposedly fly.)

Reproduction

A wide range of reproductive modes are used by snakes. All snakes employ internal fertilization, accomplished by means of paired, forked hemipenes, which are stored inverted in the male's tail. Most snakes lay eggs, and of those most species abandon them shortly after laying; however, some species are ovoviviparous and retain the eggs within their bodies until they are almost ready to hatch. Recently, it has been confirmed that several species of snake are fully viviparous, nourishing their young through a placenta as well as a yolk sac, highly unusual among reptiles, or indeed anything else outside of placental mammals. Retention of eggs and live birth are commonly, but not exclusively, associated with cold environments, as the retention of the young within the female allows her to control their temperature more effectively than if the developing young were in external eggs.

Snake bites

Documented deaths resulting from snake bites are uncommon in most areas of the world. Only about 450 species of snakes are venomous (with only about 250 that are able to kill a human), and among the 7,000 Americans bitten by venomous snakes every year, fewer than fifteen die (lightning kills more).

Venomous snakes

A **venomous snake** is a snake that uses modified saliva, venom, delivered through fangs in its mouth, to immobilize or kill its prey. (In contrast, most non-venomous species are constrictors which suffocate their prey.) Snake venom can be either a neurotoxin or a hemotoxin. Neurotoxins attack the nervous system, while hemotoxins attack the circulatory system. Venomous snakes include several families of snakes and do not constitute a formal classification group used in taxonomy.

Venomous snakes that use heomotoxins usually have their fangs to secrete the venom in the front of their mouths, making it easier for them to inject the venom into their victims. Snakes that use neurotoxins, such as the highly venomous mangrove snake, have their fangs located in the back of their mouths, with the fangs curled backwards. This makes it both difficult for the snake to use its venom and for scientists to milk them.

Evolution of Snakes

A loose joint developed in the bottom jaw of even the most primitive extinct snakes.

Venomous snakes are generally classified in four taxonomic families:

- Elapids - cobras, king cobras, kraits, mambas, Australian copperheads, and coral snakes.
  Viperids - vipers, rattlesnakes, copperheads/ cottonmouths, adders and bushmasters.
  Colubrids - boomslangs, tree snakes, vine snakes, mangrove snakes, and many others, though not all colubrids are venomous.
  Hydrophiidae - sea snakes

Snake charmers

In some parts of the world, especially in India and Pakistan, snake charming is a roadside show performed by a charmer. In this, the snake charmer carries a basket that contains a snake which he seemingly charms by playing tunes from his flute-like musical instrument, to which the snake responds. However, snakes' sense of hearing is not very sensitive to the range of the charmer's instrument, so they may not be able to hear the music at all. Researchers have pointed out that many of these snake charmers are good sleight-of-hand artists. The snake moves corresponding to the flute movement and the vibrations from the tapping of the charmer's foot which is not noticed by the public. They rarely catch their snakes and the snakes are either nonvenomous or defanged cobras. Sometimes these people exploit the fear of snakes by releasing snakes into the neighbourhood and then offering to rid the residence of snakes. Other snake charmers also have a snake and mongoose show, where both the animals have a mock fight; however, this is not very common, as the snakes, as well as the mongooses, may be seriously injured or killed.

Snake charming as a profession is now dissuaded in India as a contribution to forest & snake conservation. In fact in some places in India snake charming is banned by law.

Snake trapping

Despite the existence of snake charmers, there have also been professional snake catchers or wranglers. The tribals of "Irulas" from Andhra Pradesh and Tamil Nadu in India have been practicing this art for generations. They generally don't use gimmicks and with the help of a simple stick catch the snakes from the fields or houses. They are also known to eat some of the snakes they catch and are very useful in rat extermination in the villages. Their knowledge of snakes and their behaviour is uncanny. Modern day snake trapping involves a herpetologist using a long stick with a "V" shaped end. Some like Steve Irwin prefered to catch them using bare hands.

At least one tribe of natives uses a specialized form of snake catching as a rite of passage to manhood. The young man of interest will wrap his leg heavily in some type of cloth all the way to the inseam. He will then stick his leg in a burrow containing a large python, typically a reticulated python. After the snake swallows most of his leg several other members of the tribe will pull him out of the hole along with the snake. The snake is then killed and the man's leg removed from the snake. These snakes can be over 20 ft long and it is possible for the man to have his leg dislocated. The scent of a prey animal may be used to help convince the snake to swallow the leg. Snakes have a single-track digestive system, but the digestion process actually takes longer.

Human consumption of snakes

In some cultures, the consumption of snakes is acceptable or even considered a delicacy, prized for its alleged pharmaceutical effect of warming the heart. Western cultures document the consumption of snake under extreme circumstances of hunger. However, human consumption of snake meat, especially when eaten raw, may lead to dangerous parasitic infections in humans. Cooked Rattlesnake meat is eaten in the western United States somewhat commonly. In Asian countries drinking the blood of snakes, particularly the cobra, is believed to increase sexual virility. The blood is drained while the cobra is still alive when possible, and is usually mixed with some form of liquor to improve the taste.

Symbolism

In Egyptian history, the snake occupies a primary role with the Nile cobra adorning the crown of the pharaoh in ancient times. It was worshipped as one of the Gods and was also used for sinister purposes: murder of an adversary and ritual suicide (Cleopatra).

In Greek Mythology snakes are often associated with deadly and dangerous antagonists. The 9 headed Hydra Hercules defeated and the three Gorgon sisters are literary examples. Medusa was one of the three Gorgon sisters who Perseus defeated. Medusa is described as a hideous mortal, with snakes instead of hair and the power to turn men to stone with her gaze.

Two medical symbols involving snakes that are still used today are Bowl of Hygieia, symbolizing pharmacy, and the Caduceus and Rod of Asclepius, which are symbols denoting medicine in general.

India is often called the land of snakes and is steeped in tradition regarding snakes. Snakes are worshipped as gods even today with many women pouring milk on snake pits (despite snakes' aversion for milk). The cobra is seen on the neck of Shiva and Vishnu is depicted often as sleeping only on a 7 headed snake. There are also several temples in India solely for cobras sometimes called Nagraj (King of Snakes) and it is believed that snakes are symbols of fertility. There is a Hindu festival called Nagpanchami each year on which day snakes are venerated and prayed to.

In Christianity the snake makes its infamous appearance in the first book (Genesis) of the Bible when a snake appears before the first couple Adam and Eve and tempts them with the forbidden fruit. It is also seen in Exodus when Moses, as a sign of God's power, turns his stick into a snake; snakes are similarly produced by the pharaoh's magic-practicing priests, but Moses' snake devours them. Later Moses made Nehushtan, a bronze snake on a pole that when looked at cured the people of bites from the snakes that plagued them in the desert. Jesus instucted his disciples to be be as shrewd as snakes and as innocent as doves.

The Ouroboros is a symbol that is associated with many different religions and customs, and is also claimed to be related to Alchemy. The Ouroboros or Oroboros is a snake manifesting its own tail in a clock-wise direction (from the head to the tail)

in the shape of a circle, representing manifestation of one's own life and rebirth, leading to immortality.

Snake belongs to one of the 12 celestial animals of Chinese Zodiac, in the Chinese calendar.

In the fictional Harry Potter series, snakes had played an important role, and are mostly associated with the evil chatacters. The snake coming out of a skull is the Dark Mark symbol, used by the Death Eater.

Films

- Snakes on a Plane (2006)
  Venom (2005)
  Elektra
  Harry Potter and the Goblet of Fire (2005)
  Harry Potter and the Chamber of Secrets (2002)
  A Series of Unfortunate Events (2004)
  Anacondas: The Hunt for the Blood Orchid (2004)
  Anaconda (1997)
  Boa (2000)
  Python (2000)
  Python II
  Boa vs. Python
  Raiders of the Lost Ark (1981)
  The Jungle Book (1967)
  King Cobra
  Venomous
  Kill Bill Volume 1 and 2
  Snake King
  Ssss snake

Footnotes

1. ^ Definition of serpent - Merriam-Webster Online Dictionary. *Merriam-Webster Online Dictionary*. Retrieved on 12 October 2006.
2. ^ The thermogenesis of digestion in rattlesnakes. *Journal of Experimental Biology 207* pp. 579-585. The Company of Biologists (2004). Retrieved on 2006-05-26, 2006.

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- *Romulus Whitaker (English edition); Tamil translation by O.Henry Francis (1996). ¨®Í®È šÁŸÍ°¿¯Á³Í³ ª¾®ÍªÁ•³Í (Snakes around us, Tamil). National Book Trust. ISBN 81-237-1905-1.*

Boa genus | Colubrids | Elapids | Pythons | Vipers | Snake scales | Snakes in mythology

Boa genus

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Serpentes
Family: Boidae
Genus: ***Boa,*** Linnaeus, 1758
Species
Boa Constrictor
Acrantophis dumerili
Acrantophis madagascariensis
Sanzinia madagascariensis

Boa is a genus of snakes in the family Boidae. Four species have commonly been placed in this genus. However three of them (the Madagascar Ground Boa Acrantophis madagascariensis and the Madagascar Tree Boa Sanzinia madagascariensis and Dumerli's Boa Acrantophis dumerili (also from madagascar) are now regarded as only distantly related to the first species of the genus to be described, the Red-tailed Boa, Boa constrictor. All are nonetheless commonly known as "boa constrictors". To add further to the naming confusion, many species of snake in Boidae are known as "boas" and all are constrictors (that is, they kill their prey by constriction). Many subspecies of *Boa constrictor* have been recognised, and several have distinct common names.

Snakes of the species *Boa constrictor* are very common in Latin America, and perhaps the most sought after as pets. They can grow up to 5 metres and feed on birds and small mammals.

The Red-tailed Boa is the largest member of its family, with the largest recorded specimen being over 18 feet (5.5 m) long (though this is thought by some to possibly be a misidentification of species. It has an interesting pattern of brown and black with a red tail (see picture). It does well in captivity and tames easily and is a common sight in zoos and homes.

Species

- Red-tailed Boa, Boa constrictor
    - Amaral's Boa, Boa constrictor amarali (Stull, 1932)
      Common Red-tailed Boa, Boa constrictor constrictor (Linnaeus, 1758)
      Common Northern Boa, Boa constrictor imperator (Daudin, 1803)
      Tumbes Peru Boa, Boa constrictor longicauda (Price&Russo, 1991)
      Ecuadorian Boa, Boa constrictor melanogaster (Langhammer, 1983)
      Dominican Clouded Boa, Boa constrictor nebulosa (Lazell, 1964)
      Argentine Boa, Boa constrictor occidentalis (Philippi, 1863)
      St. Lucia Boa, Boa constrictor orophias (Linnaeus, 1758)
      Orton's Boa, Boa constrictor ortonii (Cope, 1878)
      Pearl Island Boa, Boa constrictor sabogae (Barbour, 1906)
- Duméril's Boa, Acrantophis dumerili (Jan in Jan & Sordelli, 1860)
  Madagascar Ground Boa, Acrantophis madagascariensis (Duméril & Bibron, 1844)
  Madagascar Tree Boa, Sanzinia madagascariensis (Duméril & Bibron, 1844)

Reference

- Noonan, B. P., & Chippindale, P. T. (2006). Dispersal and vicariance: The complex evolutionary history of boid snakes. *Molecular Phylogenetics and Evolution, 40*, 347-358. DOI:10.1016/j.ympev.2006.03.010

Boas

Boas

Boidae

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Serpentes
Family: **Boidae,** Gray, 1825
Genera
Acrantophis
Boa
Candoia
Corallus
Epicrates
Eryx
Eunectes
Gongylophis
Sanzinia

Boas are a type of snake that are members of the **Boidae** family. Boas are basal snakes that are "primitive" in evolutionary terms (i.e. less derived). They are constrictors and most give birth to live young. They have anal spurs, a pair of claws on each side of the cloaca which assist in mating. Boas are named after cows (Latin: *bos*) because of the old myth that boa snakes pursue cows and suckle them until they are drained to death.

Boas have two subfamilies: Boinae or true boas and Erycinae or sand boas. Pythons are sometimes classified as a subfamily of Boidae, but are frequently listed under their own family, Pythonidae.

Boidae

True boas are medium sized to large snakes. Females are usually larger than their male counterparts. Boas contain many subspecies based on locaility. They include Colombian, Suriname, Bolivian, Peruvian, Hog Island, Long Tail Peruvian, Argentine and more. The boas from the amazon basin are the most colorful possessing bright cherry red tails. It used to be said that boas were New World Snakes and pythons were Old World Snakes, but, with boas found on Madagascar and the Solomon Islands, this is not quite true. Instead, it is possible that boas have survived in evolutionarily isolated areas. South America, until a few million years ago, had a distinct fauna that included marsupial mammals; with the land bridge to North America, boas have migrated north as placental mammals and colubrids (for example) have migrated south.

- Acrantophis (Dumeril's Boa and Madagascar Ground Boa; sometimes equated with Boa)
  Boa (Red-tailed Boa, Boa constrictor, and relatives)
  Candoia (Pacific boas)
  Charina(Rosy boas)
  Corallus (Tree boas)
  Epicrates (Rainbow boas and Island boas)
  Eryx (Sand boas, Eryx johnii)
  Eunectes (Anacondas)
  Gongylophis (Gongylophis conicus)
  Sanzinia (Madagascar Tree Boa; sometimes equated with Boa)

Erycinae

Compared to true boas, erycines are quite small, with most members of this subfamily remaining well under a metre in length. Fossil erycines have been found in rock strata over 50 million years old, and were once widespread in North America. Now, only two species remain in North America, as well as the sand boas in Africa, Asia and southeastern Europe.

At least three erycine species lay eggs: the Calabar Burrowing "Python" , *Calabaria reinhardtii* (once classified as a python for this reason); the Arabian Sand Boa, *Eryx jayakari*; and the West African Sand Boa, *Eryx muelleri*.

- Calabaria reinhardtii (Calabar Burrowing "Python", Africa; sometimes equated with Charina)
  Charina bottae (rubber boas, west coast of North America)
  Eryx (Sand boa, Africa, western Asia and southeastern Europe)
  Lichanura trivirgata (Rosy boa, southwestern U.S. and northwestern Mexico; sometimes equated with Charina)
-

Colubrids

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Serpentes
Family: **Colubridae**
Subfamilies
Boodontinae
Calamariinae
Colubrinae
Dipsadinae
Homalopsinae
Natricinae
Pareatinae
Psammophiinae
Pseudoxenodontinae
Pseudoxyrhophiinae
Xenodermatinae
Xenodontinae
See text for genera.

A **Colubrid** (from Latin *coluber*, snake) is a snake that is a member of the **Colubridae** family. It is a broad classification of snakes that includes well over half of all snake species on earth. While most colubrids are non-venomous (or have venom that isn't known to be harmful to humans) and are normally harmless, a few groups, such as genus Boiga, Coluber and Rhabdophis, can produce medically significant bites. In addition, the Boomslang and African Twig Snake have both caused human fatalities.The venom-injecting fangs associated with venomous colubrids are almost always in the back of the mouth, compared to vipers and elapids.

Examples of snakes found in the colubridae family include:

- Queen snake
  Common Keelback
- King Snake
  - Milk Snake
- Corn Snake
  Bull Snake
  Rat Snake
  Garter Snake
  Hognose Snake

Indigo snake
Smooth Snake
Water Snake
Mussurana

Classification

Subfamily Boodontinae

- Bothrolycus
- Bothrophthalmus
- Buhoma (incertae sedis)
- Chamaelycus
- Dendrolycus
- Dipsina
- Dromophis
- Duberria (incertae sedis)
- Gonionotophis
- Grayia
- Hormonotus
- Lamprophis
- Lycodonomorphus
- Lycophidion
- Macroprotodon
- Mehelya
- Montaspis (incertae sedis)
- Pseudaspis
- Pseudoboodon
- Pythonodipsas
- Scaphiophis

Subfamily Calamariinae

- Calamaria
- Calamorhabdium
- Collorhabdium
- Etheridgeum
- Macrocalamus
- Pseudorabdion
- Rabdion

Subfamily Colubrinae

- Aeluroglena
- Ahaetulla
- Argyrogena
- Arizona
- Bogertophis
- Boiga

Cemophora
Chilomeniscus
Chionactis
Chironius
Chrysopelea
Coluber
Conopsis
Coronella
Crotaphopeltis
Cryptophidion
Cyclophiops
Dasypeltis
Dendrelaphis
Dendrophidion
Dinodon
Dipsadoboa
Dispholidus
Dryadophis
Drymarchon
Drymobius
Drymoluber
Dryocalamus
Dryophiops
Eirenis
Elachistodon
Elaphe
Exallodontophis
Ficimia
Gastropyxis
Geagras
Gonyophis
Gonyosoma
Gyalopion
Hapsidophrys
Hemerophis
Hemorrhois
Hierophis
Lampropeltis
Leptodrymus
Leptophis
Lepturophis
Liopeltis
Lycodon
Lycognathophis

Lytorhynchus
Masticophis
Mastigodryas
Meizodon
Oligodon
Opheodrys
Oxybelis
Pantherophis (formerly Elaphe)
Philothamnus
Phyllorhynchus
Pituophis
Prosymna
Pseudocyclophis
Pseudoficimia
Pseustes
Ptyas
Rhamnophis
Rhinobothryum
Rhinocheilus
Rhynchocalamus
Rhynchophis
Salvadora
Scaphiodontophis
Scolecophis
Senticolis
Sibynophis
Simophis
Sonora
Spalerosophis
Spilotes
Stegonotus
Stenorrhina
Stilosoma
Symphimus
Sympholis
Tantilla
Tantillita
Telescopus
Thelotornis
Thrasops
Trimorphodon
Xenelaphis

Subfamily Dipsadinae

- Adelphicos
  Amastridium
  Atractus
  Calamodontophis (incertae sedis)
  Carphophis (incertae sedis)
  Chersodromus
  Coniophanes
  Contia (incertae sedis)
  Crisantophis (incertae sedis)
  Cryophis
  Diadophis (incertae sedis)
  Diaphorolepsis (incertae sedis)
  Dipsas
  Echinanthera (incertae sedis)
  Emmochliophis (incertae sedis)
  Enuliophis (incertae sedis)
  Enulius (incertae sedis)
  Eridiphas
  Geophis
  Gomesophis (incertae sedis)
  Hydromorphus (incertae sedis)
  Hypsiglena
  Imantodes
  Leptodeira
  Ninia
  Nothopsis (incertae sedis)
  Pliocercus
  Pseudoleptodeira
  Pseudotomodon (incertae sedis)
  Ptychophis (incertae sedis)
  Rhadinaea
  Rhadinophanes (incertae sedis)
  Sibon
  Sibynomorphus
  Synophis (incertae sedis)
  Tachymenis (incertae sedis)
  Taeniophallus (incertae sedis)
  Tantalophis (incertae sedis)
  Thamnodynastes (incertae sedis)
  Tomodon (incertae sedis)
  Tretanorhinus
  Trimetopon
  Tropidodipsas
  Urotheca

Xenopholis (incertae sedis)

Subfamily Homalopsinae

- Bitia
  Brachyorrhos (incertae sedis)
  Cantoria
  Cerberus
  Enhydris
  Erpeton
  Fordonia
  Gerarda
  Heurnia
  Homalopsis
  Myron

Subfamily Natricinae

- Adelophis
  Afronatrix
  Amphiesma
  Amphiesmoides
  Amplorhinus (incertae sedis)
  Anoplohydrus
  Aspidura
  Atretium
  Balanophis
  Clonophis
  Hologerrhum
  Hydrablabes
  Hydraethiops
  Iguanognathus
  Limnophis (incertae sedis)
  Macropisthodon
  Natriciteres (incertae sedis)
  Natrix
  Nerodia
  Opisthotropis
  Parahelicops
  Pararhabdophis
  Psammodynastes (incertae sedis)
  Regina
  Rhabdophis
  Seminatrix
  Sinonatrix

Storeria
Thamnophis
Tropidoclonion
Tropidonophis
Virginia
Xenochrophis (incertae sedis)

Subfamily Pareatinae

- Aplopeltura
  Asthenodipsas (Internatus)
  Pareas

Subfamily Psammophiinae

- Hemirhagerrhis
  Malpolon
  Mimophis
  Psammophis
  Psammophylax
  Rhamphiophis

Subfamily Pseudoxenodontinae

- Plagiopholis
  Pseudoxenodon

Subfamily Pseudoxyrhophiinae

- Alluaudina
  Compsophis
  Ditypophis
  Dromicodryas
  Exallodontophis
  Geodipsas
  Heteroliodon
  Ithycyphus
  Langaha
  Leioheterodon
  Liophidium
  Liopholidophis
  Lycodryas
  Madagascarophis
  Micropisthodon
  Pararhadinaea
  Brygophis

Pseudoxyrhopus
Stenophis

Subfamily Xenodermatinae

- Achalinus
  Fimbrios
  Oxyrhabdium
  Stoliczkaia
  Xenodermus
  Xylophis

Subfamily Xenodontinae

- Alsophis
  Antillophis
  Apostolepis
  Arrhyton
  Boiruna
  Cercophis (incertae sedis)
  Clelia
  Conophis
  Darlingtonia
  Ditaxodon
  Drepanoides
  Elapomorphus
  Erythrolamprus
  Farancia
  Helicops
  Heterodon
  Hydrodynastes
  Hydrops
  Hypsirhynchus
  Ialtris
  Lioheterophis (incertae sedis)
  Liophis
  Lystrophis
  Manolepis
  Oxyrhopus
  Phalotris
  Philodryas
  Phimophis
  Pseudablabes
  Pseudoboa
  Pseudoeryx

Psomophis
Rhachidelus
Saphenophis
Siphlophis
Sordellina (incertae sedis)
Tropidodryas
Umbrivaga
Uromacer
Uromacerina
Waglerophis
Xenodon
Xenoxybelis

incertae sedis

- Blythia
  Cercaspis
  Cyclocorus
  Elapoidis
  Gongylosoma
  Haplocercus
  Helophis
  Myersophis
  Omoadiphas (recently discovered)
  Oreocalamus
  Poecilopholis
  Rhabdops
  Tetralepis
  Thermophis
  Trachischium

Rat snakes | Corn Snake

Rat snakes

Rat snakes are a large, polyphyletic, group of snakes from the Colubrid subfamily Colubrinae. There is considerable variation between different types of rat snake but most are medium to large, rodent eating snakes.

Previously most were assigned to the genus Elaphe but many have been since renamed. The validity of some genera is debatable but for the purpose of this article a more liberal taxonomic stance will be taken. Rat snakes have traditionally been divided into two groups, New World and Old World species.

Examples of snakes found in the Elaphe include:

- Elaphe bairdi
  Elaphe bimaculata
  Elaphe carinata
  Elaphe climacophora
  Elaphe conspicillata
  Elaphe davidi
  Elaphe dione
  Elaphe emoryi
  Elaphe erythrura
  Elaphe flavirufa
  Elaphe flavolineata
  Elaphe gloydi
  Elaphe guttata
  Elaphe helena
  Elaphe hohenackeri
  Elaphe leonardi
  Elaphe lineata
  Elaphe longissima
  Elaphe maculata
  Elaphe mandarina
  Elaphe moellendorffi
  Elaphe obsoleta
  Elaphe perlacea
  Elaphe persica
  Elaphe porphyracea
  Elaphe prasina
  Elaphe quadrivirgata
  Elaphe quatuorlineata
  Elaphe radiata
  Elaphe rufodorsata

Elaphe scalaris
Elaphe schrenckii
Elaphe situla
Elaphe subradiata
Elaphe taeniura
Elaphe vulpina

New World Rat Snakes

New World rat snakes belong to the Colubrine tribe Lampropeltinae, and as such are closely related to Lampropeltis (milk snakes and king snakes), Pituophis (gopher snakes, pine snakes and bull snakes), Rhinocheilus (longnose snakes), Arizona (glossy snakes) and Stilosoma (short-tailed snakes). The entire Lampropeltinid group is descended from Old World rat snakes that crossed the Bering Land Bridge sometime within the last twenty to thirty million years.

The New World rat snakes consist of the genera Bogertophis (Trans Pecos and Baja rat snakes), Elaphe (Pantherophis) (Corn snakes, Fox snakes and American rat snakes), Pseudelaphe (Central American rat snake) and Senticola (Green rat snake).

Old World Rat Snakes

The Genera Elaphe, Euprepiophis, Oreophis, Orthriophis, Rhinechis, and Zamenis constitute Old-World rat snakes.

Additional Note

It is worth noting that, though the polyphyletic nature of the genus is almost undisputed, many species are conservatively referred to as *Elaphe* sp. See, for instance, Black Rat Snake and Grey Rat Snake, subspecies of *Pantherophis obsoleta*.

Corn Snake

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
Suborder: Serpentes
Family: Colubridae
Genus: *Elaphe*
Species: ***E. guttata***
Binomial name: ***Elaphe guttata,*** Linnaeus, 1766
Synonyms
Coluber guttatus
Coluber maculatus
Coluber compressus
Coluber carolinianus
Coluber molossus
Coluber pantherinus
Coluber floridanus
Coryphodon Pantherinus
Coluber guttatus sellatus
Coluber rosaceus

The **Corn Snake or Red Rat Snake** (*Elaphe guttata*) is a species of Rat Snake. The Latin word *elaphe* means deerskin.[1] Popular in the pet trade, they are known for being smaller and less aggressive than other Rat Snake species. They are **non-venomous**, another reason why they are often kept as pets. Their average adult length is about 1-6 feet and they may live to be 30 years old in captivity. They are found throughout the south-eastern and central United States as well as parts of Mexico. The name 'corn snake' refers to the splotched pattern on its belly, which resembles Indian maize. Some, however, believe it is because they are often found in corn fields searching for mice.

Contents

Subspecies

There are two subspecies of *Pantheropis guttatus*, referred to as the Corn Snake or Red Rat Snake and the Emory's Rat Snake or Great Plains Rat Snake:

- Common Corn Snake (*Pantheropis guttatus*) is prevalent in the southeastern United States and is distinguished by having orange skin with red blotches, the blotches having black borders.
- Great Plains Rat Snake (*Pantheropis emoryi*) is prevalent in both central North America and also parts of Mexico. Some have also been seen as far North as Michigan and east to Massachusetts. Great Plains Rat Snakes are less colorful than the nominant species, often being light gray or tan with dark gray blotches, sometimes with a hint of olive green. However, the Emory subspecies has a lot of yellow pigmentation in its genetics that have been monopolized by the pet trade. This subspecies is often stouter and larger and produces fewer eggs per clutch than its predominantly southeastern counterpart. While Great Plains Rat Snakes can be kept as pets, some individuals are more aggressive than the *guttata* subspecies.

Taxonomy

In 2002, all North American rat snakes of the genus Elaphe were suggested for reclassification into the genus Pantherophis, thus changing the scientific name of the Corn Snake from *Elaphe guttata* to *Pantherophis guttatus*, however many people have not accepted the change, and it is still widely referred to as *Elaphe*.

In 2003 Herpetological Review rejected the change from Elaphe to Pantherophis on the basis that further research was needed. Furthermore, the International Committee for Zoological Nomenclature has not ruled on the change. Taxonomic changes do not become official until they are approved by the ICZN, until such time any published articles with reclassification of the taxonomic names are regarded as taxonomic suggestions. Official taxonomy, whether used or not, remains with the older nomenclature until changes are approved by the ICZN.

Habitat

Wild Corn Snakes prefer habitats such as overgrown fields, forest openings, and abandoned or seldom used buildings.

Habits

In the wild, Corn Snakes tend to be quite secretive and appear to be active mostly at night. During daylight hours they may be found hiding under loose tree bark and beneath logs, rocks, and other debris.

Diet

Corn snakes, as with all Rat Snakes, have a diet primarily consisting of rodents, but they are proficient climbers and may scale trees in search of birds, bird eggs and bats. As litters of infant mice are difficult to find in nature, many baby Corn Snakes are known to eat small lizards as their first meals, and Carolina anoles are the preferred choice. Some individuals retain these dietary tendencies well into adulthood. Pet corn snakes are usually fed by their owners on a diet of commercially available rodents, predominantly mice.

Corn Snakes as pets

Corn snakes are ideal pets and are one of the most widely available snakes in the pet trade. They are a good choice for a beginner snake keeper due to the fact that Corn Snakes have a comparatively docile temperament, are robust, and are more tolerant of basic husbandry mistakes than most other snakes. Also, Corn Snakes are widely captive bred, so healthy specimens are readily available. Corn snakes can live as long as 30 years in captivity, averaging closer to 15-20 years.

No matter how easily corn snakes can be kept, intensive research must be carried out before obtaining one, as their care needs are relatively complex. A vet that treats reptiles must also be sought beforehand, as few vets practice "exotic" medicine.

The advice provided here is basic and not adequate reading on its own. Research should cover multiple sources, including books. Always inquire in to the legality of corn snake ownership in your local jurisdiction. Certain jurisdictions outlaw the trade and/or ownership of native non-venomous species.

Selection of a Specimen

When looking for corn snake specimens look for healthy individuals. Emaciated or sickly specimens have loose or sagging skin. Other signs of poor health may include and are not limited to incomplete shedding, sores on the skin, scar tissue, bubbles or mucus around the mouth and lethargic behavior. Always inspect specimens closely for ectoparasites such as mites or ticks. It is generally wise to avoid purchasing wild caught specimens.

Setting up a Vivarium

A basic vivarium (or "terrarium") for a corn snake should consist of at least: a 20 gallon or larger vivarium (30" x 12½" x 13") with secure screen cover, a suitable substrate (no pine or cedar,) a heater set between 80-85 ºF, a water dish and a hide at both the warm and cool end. The vivarium should be fully set up before obtaining a snake, as this will allow you to observe and adjust the temperatures beforehand. Only one corn snake should be kept in a vivarium or other enclosure. Keeping multiple snakes together can lead to the spread of diseases or parasites, or it can even lead to cannibalism.

A hide should be placed at each end of the temperature gradient, as this will allow the snake to thermoregulate without the fear of being forced out into the open. Hides can be as simple as cardboard boxes and should be replaced when soiled (along with the bedding immediately surrounding it.) A more natural look can be obtained by purchasing half-log hides and hides that resemble rock formations.

Placement of a Vivarium

The correct placement of a vivarium can reduce stress. Incorrect placement can lead to a nervous and unhealthy animal. The vivarium should be:

- Away from audio equipment such as stereos. Snakes "hear" through vibrations and the vibrations from a constant bassline can upset them. If this cannot be achieved padding underneath the vivarium can help reduce the vibrations.
- Away from rooms next to busy roads. Once again, the vibrations can cause stress to the snake.
- Up off the floor to prevent drafts chilling your snake, and to prevent some inevitable vibrations.

Feeding

Captive corn snakes should only be fed commercial mice, as wild caught prey can carry diseases or parasites. Sizes range from "pinkie" to adult, and most pet stores carry all sizes in both live and frozen varieties, the latter of which being the preferred choice as live mice can cause injuries. However, some snakes refuse to eat dead mice. Frozen mice should be thawed completely before being offered. Mice should be no larger than thickest part of the snake, and should generally be given once a week. There is disagreement as to whether multiple mice should be given at one time, but it is widely known that a snake that is given a mouse that is too large will often have problems with digestion, often regurgitating the mouse.

Heating

A heat gradient must be provided so that the snake can

thermoregulate. The warm end must have an ambient temperature of 80-85F. Temperatures that are too hot or too cold will result in an ill snake that cannot digest its meals properly.

Heat can be provided via a light bulb (it is wise to provide a guard for this so that the snake cannot touch it), an undertank heat mat or a ceramic heater. Heating devices should be controlled by thermostats. **Hot rocks should never be used.** They cause a dangerous source of localized heat. Many snakes have been severely burned by these devices. It causes thermal burns.

Two thermometers should be used to measure temperature - simply guessing the temperature is not adequate. Two thermometers - one at each end of the vivarium - allow you to observe the heat gradient.

Cleaning

Fecal matter and molting should be removed immediately. At least once a month a substantial cleaning should be performed, in which the bedding is replaced. The tank and everything in it should also be washed with a weak bleach solution during this time, as this will ensure that the environment stays relatively sterile and also helps prevent the growth of parasites.

Handling

Although docile, corn snakes - like all animals - can be stressed by excessive handling. Not handling a specimen at all is also not advised as you may find yourself with a snake that reverts to wild behaviour and cannot be handled at all. Handling your snake also lets you check for any abnormalities which may require the attention of a vet. Handling benefits your snake in that it exercises and can explore something other than its enclosure. Although snakes are not as intelligent as a dog or cat, environmental stimulation should be provided.

Corn snakes can be active when held and must be supervised constantly when out of their vivariums.

It is highly recommended that you do not handle your snake for at least three days after it has eaten, to allow it time to digest its food. Handling too soon after a feed will result in regurgitation, which can be serious.

Breeding

While it is easy to avoid unexpected clutches of eggs with most species of snakes by denying them of brumation, or an artificial hibernation period, corn snakes will readily breed in captivity without any hibernation period. The eggs should be stored in moist vermiculite or sphagnum moss between 78 and 90 degrees Fahrenheit (26 to 32 degrees Celsius). Unlike most birds' eggs, the eggs must not be rotated or repositioned past the first few days after laying. If they are kept warm and moist the baby snakes should emerge after 70 days.

Variations

After many generations of selective breeding, domesticated corn snakes are found in a wide variety of different colors and patterns. These result from recombining the dominant and recessive genes that code for proteins involved in chromatophore development, maintenance or function.

Color Morphs

- **Miami Corn** (Florida wildtype) These are usually a smallish corn snake with better specimens having high contrasting light silver to gray ground color with orange blotches surrounded in black. Selective breeding has lightened the ground color and darkened the blotches. The "Miami" name, coined by Rich Zuchowski, now is considered an appearance trait. Many Miami corn snakes are difficult to start feeding as hatchlings, as they prefer lizards. Miami corns, unlike other varieties, will often readily accept anoles as food for life. This can simplify feeding for residents of Florida, but care should be taken to avoid introducing parasites from wild caught food.
- **Okeetee Corns** (classic corns, South Carolina wildtype) These snakes are characterized by deep red dorsal blotches surrounded by very black borders. The ground color varies with bright orange being the most desirable. As with the Miami phase, selective breeding has changed the term "Okeetee" to an appearance trait rather than a local designation. Over hunting in their natural range for the pet trade has caused a decline in wild Okeetee specimens. Responsible purchasers should seek captive bred Okeetees.
- **Amelanistic** (red albino) corn snakes, produced from a single recessive genetic mutation, show wide variations in colors. They can be almost solid orange, to a dark orange on a light orange background, or red/orange on a very light background. These varying color schemes are due to reflective cells in the skin and iridophores which may contribute to subtle shades of color. These red eyed snakes lack the melanin pigment.
- **Candy Cane** corn snakes are created with the goal of obtaining bright red blotches on a white background. Some on the market originate solely from selectively breeding Miami corns. Others are produced using light creamsicle (emory/albino corn hybrids x corn) bred with Miami phase corns. Most candy canes develop

orange coloration around the neck region as they mature. Their bright red markings as hatchlings often fade with maturity.

- **Albino Okeetee** (reverse okeetee) an amelanistic okeetee corn snake which has the normal black rings around blotches replaced with wide white rings. Most are high contrast snakes with light orange to yellow background and dark orangish/red saddles. *Note: Albino Okeetees are not okeetees, they are selectively bred amelanistics*
- **Sunglow** corn snakes are another designer albino corn that lacks the usual white speckling that often appears in most albinos. The orange background surrounds dark orange blotches.
- **Charcoal** These Anerythristic type 'B' snakes are lacking the yellow color pigment usually found in all corn snakes. This morph is the starter for blizzard corns.
- **Anerythristic** (black albino) are the compliment to amelanism. The inherited recessive mutation of lacking erythrin (red, yellow, and orange) pigments produce a snake that is mostly black and gray. When mature, many type A anerythristic corn snakes develop yellow on their neck regions. In 1984 a wild caught Type B anerythristic corn snake was caught which is the ancestor of anerythristics missing the yellow neck regions. Similar snakes include: stonewashed -- copper or light brown blotches; charcoal (aka muted anerythristic, Pine Island anerythristic)-- type B anerythristic, very low contrast with shaded of gray on white and black background.
- **Snow** (white albino) are a blending of the amelanistic and anerythristic recessive traits. These predominantly white snakes tend to have yellow neck and throat regions when mature. Light blotches and background colors have subtle shades of beige, ivory, pink, green, or yellow.
- **Blizzard** corns resulted from a type B anerythristic corn caught in 1984. Blizzards are a totally white snake with very little to no visible pattern.
- **Hypomelanistic** or rosy corn snakes carry a recessive trait that reduces the dark pigments causing the reds, whites, and oranges to become more vivid. Their eyes remain dark. These snakes range in appearance between amelanistic corns snakes to normals with greatly reduced melanin.
- **Ghost** corn snakes are a hypomelanistic anerythristic (type A) snakes. They exhibit varying shades of grays, browns, and blacks on a lighter background. These often create pastel colors in: lavenders, pinks, oranges, and browns.
- **Bloodred** corn snakes carry a recessive trait that eliminates

ventral checkered patterns. These originated from a somewhat unicolor Jacksonville and Gainesville, Florida strain of corn snake. Through selective breeding, an almost solid ground color has been produced. Hatchlings have a slight pattern that fade as they mature into a solid orange red to ash red colored snake. The earlier bloodreds tend to have large clutches of smaller than average eggs that produce hard to feed offspring. Through out crossing with amelanistic and anerythristic corns hatchlings tend to be larger with fewer feeding problems.

- **Butter corns** (snow caramel) cultured by Rich Zuchowski from a female purchased in Florida marked with blotches on an unusual straw colored background. Selective breeding has produced intense yellow colored corns snakes with yellow markings.
- **Caramel** corns are another Rich Zuchowski engineered corn snake. The background is varying shades of yellow to yellow brown. Dorsal blotches vary from caramel yellow, brown, and rich chocolate brown.
- **Amber** corns are a hypomelanistic caramel snake with amber markings on a brownish background.

- **Lavender** corn snakes contain a light pink background with darker purple gray markings and burgundy eyes or lavender gray blotches on an orangish background. Variation with this same genetic strain are arguably called: mocha, cocoa, and chocolate.
- **Albino lavender** look like blizzard corns once mature with pink to purple highlights.
- **Crimson** (hypomelanistic Miami) are very light high contrast snakes with a light background and dark reddish/orange blotches.
- **Fluorescent orange** develop white borders around bright red blotches as adults on an orange background.
- **Pewter** or **Peppercorn** (Type B Anerytheristic blood red) are silvery lavender with very slight blotches as adults.
- **Creamsicle** are hybrids between an albino corn snake and an emory's ratnsake/common corn cross. These snakes bring out the yellow and downplay the reds of the corn snake. Most are varying shades of yellow with darker yellow to orangish blotches. Clutches are generally smaller in number but produce larger more vigorous hatchlings. Creamsicle with less emory background and increased amelanistic corn generally have lighter backgrounds and red to orange saddles(red creamsicle).
- **Jungle** corns are hybrids using the corn snake and California

Kingsnake (*Lampropeltis getula californiae*). These show extreme pattern variations taking markings from both parents -- sometimes looking very similar to one parent or the other. However, as a hybrid of different species, these attractive snakes are typically sterile.

Pattern Morphs

- **Aztec:** blotches and spots are exhibited in various sizes
- **Milksnake phase:** banded blotches resembling coastal plains milk snake.
- **Motley:** a catch all name for irregularities -- ranging from exhibiting an aberrant line of light colored spots, fused blotches, to stripes down the back
- **Striped phase:** a single stripe running longitudinally from head to tail
- **Zigzag (zipper):** dorsal blotches connected forming a "zigzag" type pattern

See also the **Jungle** variety listed under colors.

Elapids

Elapidae

Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Class: Reptilia
Order: Squamata
Suborder: Serpentes
Family: **Elapidae,** Boie, 1827

The **Elapidae**, or elapids, are a family of highly venomous snakes found in tropical and subtropical regions around the world, including the Indian Ocean and the Pacific. They are characterized by possessing a set of hollow, fixed fangs through which they inject venom, and come in a wide range of sizes, from only 18 cm (Drysdalia) up to 6 m in length (Ophiophagus). This group is currently comprised of two subfamilies.

Contents

Description

Outwardly, terrestrial elapids look similar to the colubridae: almost all have long and slender bodies with smooth scales, a head that is covered with large shields and not always distinct from the neck, and eyes with round pupils. In addition, their behavior is usually quite active and most are oviparous.

Sea snakes, which are also elapids, have adapted to a marine way of life in different ways and to various degrees. Characteristics can include laterally compressed bodies, rudder-like tails for swimming, the ability to excrete salt and give birth to live young (ovoviviparous). Some genera, including Hydrophis, have ventral scales that are much reduced in size. Others, like the olive sea snakes (Aipysurus sp.) can absorb oxygen from the surrounding water directly through their skin and may obtain 10-22% in this manner. The sea kraits (Laticauda sp.), seem to be the least well-adapted to an aquatic life, having wide ventral scales, a poorly developed tail fin and needing to return to land in order to mate and lay eggs (oviparous).

All elapids have a pair of proteroglyphous (hollow) fangs that are used to inject venom from glands located towards the rear of the upper jaws. Each of the two fangs is located at the front of the mouth on a largely immovable and short maxillary bone. When the mouth is closed, the fangs fit into grooved slots in the buccal floor. Due to this construction, elapids must actually bite in order to envenomate. This action is therefore not as quick as with the viperids, that can envenomate with only a quick, stabbing motion. Elapids use their venom both to immobilize their prey and in self-defense.

Venom

All elapids are venomous and many are potentially deadly. The venoms are mostly neurotoxic and are considered more dangerous than the mainly proteolytic viper venoms. Members include the Black Mamba (Dendroaspis polylepis), a species many regard as the world's most dangerous snake, the Fierce Snake (Oxyuranus microlepidotus), the most venomous land snake, but not Hydrophis belcheri, a sea snake and the most venomous snake of all, which is a member of the Hydrophiidae.

Taxonomy

The table below lists all of the elapid genera and no subfamilies. In the past, many subfamilies were recognized, or have been suggested for the Elapidae, including the Elapinae, Hydrophiinae (sea snakes), Micrurinae (coral snakes), Acanthophiinae (Australian elapids) and the Laticaudinae (sea kraits). Currently, none are universally recognized. It seems certain that the elapids will be broken up eventually, but there are still a number of unresolved issues as to how this should be done. One involves the former Hydrophiidae, a group for which Rasmussen (2002) provided evidence suggesting that its members are phylogenetically more related to other elapids than they are to each other.

The type genus for the Elapidae was originally Elaps, but that group was moved to another family. In contrast to what usually happens in botany, the Elapidae family was not renamed. In the meantime, Elaps was renamed Homoroselaps and moved back to the Elapidae. However, Nagy et al. 2005 regard it as a sister taxon to Atractaspis which should therefore have been assigned to the Atractaspididae.

Genera

Genus	Authority	Species	Subsp.*	Common name	Geographic range
Acalyptophis	Boulenger	1	0	Spiny-headed seasnake	Gulf of Thailand, South China sea, coast of Guangdong and Strait of Taiwan, Indonesia, Philippines, New Guinea, New Caledonia, Australia (Northern Territory, Queensland, Western Australia)
Acanthophis	Daudin,	9	2	Death adders	Australia, New Guinea, Indonesia (Seram, Tanimbar)
Aipysurus	Lacépède,	8	0		Timor Sea, South China Sea, Gulf of Thailand, coast of Australia (North Territory, Queensland, West Australia), New

					Caledonia, Loyalty Islands, southern New Guinea, Indonesia, western Malaysia, Vietnam
Aspidelaps	Fitzinger,	2	5	Shieldnose cobras	South Africa (Cape Province, Transvaal), Namibia, southern Angola, Botswana, Zimbabwe,Mozan
Aspidomorphus	Fitzinger	3	3	Collared adders	New Guinea
Astrotia	Fischer	1	0	Stoke's sea snake	Coastal areas from west India and Sri Lanka through Gulf of Thailand to China Sea, west Malaysia, Indonesia east to New Guinea, north and east coasts of Australia, Philippines
Austrelaps	Worrell	3	0	Australian Copperheads	Australia (South Australia,

					New South Wales, Victoria, Tasmania)
Boulengerina	Dollo	2	1	Water cobras	Cameroon, Gabon, Democratic Republic of the Congo, Congo, Central African Republic, Tanzania, Equatorial Guinea, Rwanda, Burundi, Zambia
Bungarus	Daudin	12	5	Indian kraits	India (incl. Andaman Island), Myanmar, Nepal, Vietnam, Afghanistan, Pakistan, Sri Lanka, Bangladesh, Cambodia, Indonesia (Java, Sumatra, Bali, Sulawesi), Peninsular Malaysia, Singapore, Thailand
Cacophis	Günther	4	0	Dwarf crowned snakes	Australia (New South Wales, Queensland)
Calliophis	Gray	11	18	Oriental	India,

				coral snakes	Bangladesh, Sri Lanka, Nepal, Indonesia, Cambodia, Malaysia, Singapore, Thailand, Burma, Brunei, Philippines, Vietnam, Laos, southern China, Japan (Ryukyu Islands), Taiwan
Demansia	Gray	8	3	Venomous whip snakes	New Guinea, continental Australia
Dendroaspis	Schlegel	4	2	Mambas	Kenya, Tanzania, Mozambique, Malawi, Zimbabwe, South Africa, Ghana, Togo, Benin, Nigeria, Cameroon, Guinea, Gabon, Principe (Gulf of Guinea), Central African Republic, Democratic

					Republic of the Congo, Congo, Uganda, Rwanda, Burundi, Equatorial Guinea, Angola, Sudan, Botswana, Burkina Faso, Eritrea, Senegal, Mali, Ethiopia, Ivory Coast, Namibia, Somalia, Swaziland, Zambia, Gambia, Guinea Bissau, Liberia, Ivory Coast, Sierra Leone
Denisonia	Krefft, 1869	2	0	Ornamental snakes	Central Queensland and central northern New South Wales, Australia
Disteira	Worrell, 1961	4	0		
Drysdalia	Worrell, 1961	3	0	Australian crowned snakes	Australia
Echiopsis	Fitzinger,	2	0	Bardick	Australia

	1843			snakes	
Elapognathus	Boulenger, 1896	2	0	Little brown snakes	Australia
Elapsoidea	Bocage, 1866	9	7	Venomous garter snakes	Senegal, South Africa, Mozambique, Namibia, Botswana, Zimbabwe, Swaziland, Gambia, Angola, Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Ghana, Ivory Coast, Malawi, Mali, Mauritania, Niger, Nigeria, Uganda, Senegal, Sudan, Tanzania, Togo, Democratic Republic of the Congo, Congo, Zambia, Kenya, north Burundi, Rwanda,

					Ethiopia, Uganda, Somalia
Emydocephalus	Krefft, 1869	2	0	Turtlehead sea snakes	
Enhydrina	Gray, 1849	2	0	Beaked sea snakes	
Ephalophis	M.A. Smith, 1931	1	0	Grey's sea snake	
Furina	Duméril, 1853	5	0	Naped snakes	
Hemachatus	Fleming, 1822	1	0	Spitting cobra	South Africa, Zimbabwe, Lesotho, Swaziland
Hemiaspis	Fitzinger, 1861	2	0	Swamp snakes	
Hemibungarus	Peters, 1862	3	2	Asian coral snakes	Taiwan, Japan (Ryukyu Islands)
Homoroselaps	Jan, 1858	2	0	Harlequin snakes	
Hoplocephalus	Wagler, 1830	3	0	Pale-headed snakes	Eastern Australia
Hydrelaps	Boulenger, 1896	1	0	Port Darwin seasnake	
Hydrophis	Latreille, 1801	29	5	Asian sea snakes	
Kerilia	Gray, 1849	1	1	Jerdon's sea snake	
Kolpophis	M.A. Smith, 1926	1	0	Bighead sea snake	
Lapemis	Gray, 1835	2	0	Shaw's sea snake	
Laticauda	Laurenti, 1768	7	2	Sea kraits	
Leptomicrurus	Schmidt, 1937	4	2	Blackback Coral	

				Snake	
Loveridgelaps	McDowell, 1970	1	0	Solomon's small-eyed snake	
Micropechis	Boulenger, 1896	1	0	New Guinea small-eyed snake	
Micruroides	Schmidt, 1928	1	2	Western coral snakes	USA (Arizona, SW New Mexico), Mexico (Sonora, Sinaloa)
Micrurus	Wagler, 1824	68	64	Coral snakes	
Naja	Laurenti, 1768	21	5	Cobras	
Notechis	Boulenger, 1896	2	4	Tiger snakes	Southern Australia, including many offshore islands
Ogmodon	Peters, 1864	1	0	Fiji cobra	
Ophiophagus	Günther, 1864	1	0	King cobra	Bangladesh, Myanmar, Cambodia, China, India, Andaman Islands, Indonesia, Laos, Thailand, Vietnam, west Malaysia, Philippines
Oxyuranus	Kinghorn, 1923	2	1	Taipans	Australia, New Guinea

Parahydrophis	Burger & Natsuno, 1974	1	0	Northern mangrove sea snake	
Paranaja	Loveridge, 1944	1	2	Many-banded snakes	West/central Democratic Republic of the Congo, Congo, Cameroon
Parapistocalamus	Roux, 1934	1	0	Hediger's snake	
Pelamis	Daudin, 1803	1	0	Yellow-bellied sea snake	
Pseudechis	Wagler, 1830	7	2	Black snakes (and king brown)	Australia
Pseudohaje	Günther, 1858	2	0	Forest cobras	Angola, Burundi, Cameroon, Central African Republic, Democratic Republic of the Congo, Congo, Gabon, Ghana, Kenya, Nigeria, Rwanda, Uganda, Sierra Leone, Liberia, Ivory Coast, Togo, Nigeria
Pseudonaja	Günther, 1858	8	3	Venomous brown	Australia

				snakes (and dugites)	
Rhinoplocephalus	Müller, 1885	6	0		
Salomonelaps	McDowell, 1970	1	0	Solomons coral snake	
Simoselaps	Jan, 1859	14	3	Australian coral snakes	
Suta	Worrell, 1961	10	2	Curl snake	Australia
Thalassophina	P. Schmidt, 1852	1	0	Schmidt's sea snake	
Thalassophis	P. Schmidt, 1852	1	0	Anomalous sea snake	
Toxicocalamus	Boulenger, 189	9	1	Forest snakes	
Tropidechis	Günther, 1863	1	0	Rough-scaled snake	Eastern Australia
Vermicella	Gray, 1858	5	0	Bandy-bandies	
Walterinnesia	Lataste, 1887	1	0	Black desert cobra	Egypt, Israel, Lebanon, Syria, Jordan, Iraq, Iran, Kuwait, Saudi Arabia

**) Not including the nominate subspecies (typical form).*

Pythons

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Subclass: Lepidosauria
Order: Squamata
Suborder: Serpentes
Superfamily: Henophidia
Family: **Pythonidae**
Genera
Aspidites
Antaresia
Apodora
Bothrochilus
Leiopython
Liasis
Morelia
Python

Python is the common name for a group of non-venomous constricting snakes, specifically the family Pythonidae. Other sources consider this group a subfamily of the Boas (Pythoninae). Pythons are more related to boas than to any other snake-family. There is also a genus within Pythonidae which carries the name Python (Daudin, 1803). Pythons are distinguishable from boas in that they have teeth on the premaxilla, a small bone at the very front and center of the upper jaw. Most boas produce live young, while pythons produce eggs. Some species of sandboas (Ericinae) are also called python.

Contents

Geographic Range and Habitat

Pythons are found in Australia, Southeast Asia, Africa and South America

Most pythons live in the dense underbrush of rugged tropical rainforest regions. They are excellent climbers; some species, like the Green Tree Python, are arboreal. Like all snakes, they are also capable swimmers.

Description

Pythons range in size from 1 to 6 metres (3 to 20 feet) in length. Some pythons are among the longest species of snakes in the world; according to the Guinness Book of World Records the Reticulated Python holds the record for longest snake, at 10m (32ft 9.5in).

Some species exhibit vestigial bones of the pelvis and rear legs, which are externally apparent in the form of a pair of anal spurs on each side of the cloaca. These spurs are larger in males than females, and are used by the male to stimulate the female during copulation.

Some pythons display vivid patterns on their scales while others are a nondescript brown. They usually reflect appropriate camouflage for their native habitat.

There has been a report[of a python 49 feet = 14.85 meters long found on Java in Indonesia, but there has been doubt about that claim.

Behavior

Pythons are constrictors, and feed on birds and mammals, killing them by squeezing them to death. They coil themselves up around their prey, tighten, but merely squeeze hard enough to stop the prey's breathing and/or blood circulation. Large pythons will usually eat something about the size of a house cat, but larger food items are not unknown (some large Asian species have been known to take down adult Deer, and the African Rock Python has been documented preying upon Gazelle). They swallow their prey whole, and take several days or even weeks to fully digest it. Despite their intimidating size and muscular power, they are generally not dangerous to humans. While a large adult python could kill a human being (most likely by strangling rather than actual crushing), humans are outside the normal size range for prey. Reports of python attacks on humans are extremely rare. Despite this, pythons have been aggressively hunted, driving some species (like the Indian Python) to the brink of extinction.

Most pythons have heat-sensing organs in their lips. These enable them to detect objects that are hotter than the surrounding environment. Pythons that do not have heat-sensing organs identify their prey by smell. Pythons are ambush predators: they typically stay in a camouflaged position and then suddenly strike at passing prey. They then grasp the prey in their teeth, and kill by constriction. Death is usually a result of suffocation or heart failure rather than crushing. Pythons will not usually attack humans unless startled or provoked, although females protecting their eggs can be aggressive.

Reproduction

Pythons lay eggs which they arrange in a pile. They coil around the pile until all eggs have hatched. Since pythons cannot regulate their internal body temperature, they cannot incubate their eggs *per se*; instead, they raise the temperature of their eggs by small movements of their body—essentially, they "shiver". This is one of only a few documented cases of parental behaviour in snakes.

In Captivity

Most species of python are available in the exotic pet trade.

The larger species such as the Burmese python and Reticulated Python should only be owned by those with experience of snakes. Cases of large pet pythons killing their owners have been documented.

The Everglades National Park has had an invasive population of Burmese Pythons that have caused harm to the natural environment of the Everglades; more than 200 have been removed.

Species

Genus *Aspidites*

- Black-headed Python, Aspidites melanocephalus (Krefft, 1864)
- Woma Python, Aspidites ramsayi (Macleay, 1882)
    - Western Woma Python, Aspidites ramsayi panoptes (Hoser, 2000)
    Desert Woma Python, Aspidites ramsayi richardjonseii (Hoser, 2000)

Genus *Antaresia*

- Children's Python, Antaresia childreni (Gray, 1842)
Spotted Python, Antaresia maculosa (Peters, 1873)
Pygmy Python, Antaresia perthensis (Stull, 1932)
Stimson's Python, Antaresia stimsoni (Smith, 1985)

Genus *Apodora*

- Papuan Python, Apodora papuana (Peters & Doria, 1878)

Genus *Bothrochilus*

- Bismark Ringed Python, Bothrochilus boa (Schlegel, 1837)

Genus *Leiopython*

- Northern (D'Albertis') White-lipped Python, Leiopython albertisii (Peters & Doria, 1878)
    - Leiopython albertisii barkeri (Hoser, 2000)
    Brown White-lipped Python, Leiopython albertisii bennetti (Hoser, 2000)
- Southern (Black) White-lipped Python, Leiopython hoserae (Hoser, 2000)

Genus *Liasis*

- Brown Water Python, *Liasis fuscus*
    - Dauan Island Water Python, Liasis fuscus cornwallisius (Gunther, 1879)
    Liasis fuscus fuscus (Peters, 1873)
    Liasis fuscus jackyae (Hoser, 2003)
- Indonesian Water Python, Liasis mackloti
    - Wetar Island Python, Liasis mackloti dunni (Stull, 1932)

  - Macklot's Python, Liasis mackloti mackloti (Duméril & Bibron, 1844)
  - Savu Python, Liasis mackloti savuensis (Brongersma, 1956)
- Olive Python, *Liasis olivaceus*
  - Liasis olivaceus olivaceus (Gray, 1842)
  - Liasis olivaceus barroni (Smith, 1981)

Genus *Morelia*

- Amethistine Python, Morelia amethistina (Schneider, 1801)
- Boelen's Python, Morelia boeleni (Brongersma, 1953)
- Centralian Carpet Python or Bredl's Python, Morelia bredli (Gow, 1981)
- Rough-scaled Python, Morelia carinata (Smith, 1981)
- Mollucan Python, Morelia clastolepis (Harvey, Barker, Ammerman & Chippindale)
- Australian Scrub Python, Morelia kinghorni (Stull, 1933)
- Morelia macburniei (Hoser, 2003)
- Flinders Python, Morelia mippughae (Hoser, 2003)
- Tanimbar Python, Morelia nauta (Harvey, Barker, Ammerman & Chippindale)
- Oenpelli Python, Morelia oenpelliensis (Gow, 1977)
- Carpet Python, Morelia spilota
  - New Guinea Carpet Python, Morelia spilota harrisoni (Hoser, 2000)
  - Southwestern Carpet Python, Morelia spilota imbricata (Smith, 1981)
  - Jungle Carpet Python, Morelia spilota cheynei (Wells & Wellington, 1985)
  - Morelia spilota macrospila (Werner, 1910)
  - Coastal Carpet Python, Morelia spilota mcdowelli (Wells & Wellington, 1985)
  - Diamond Python, Morelia spilota spilota (La Cépède, 1804)
  - Northwestern Carpet Python, Morelia spilota variegata (Gray, 1842)
  - Inland Carpet Python, Morelia spilotes metcalfei (Wells & Wellington, 1985)

- Halmahera Python, Morelia tracyae (Harvey, Barker, Ammerman & Chippindale)
- Green Tree Python, Morelia viridis
  - Morelia viridis viridis (Schlegel, 1872)

Morelia viridis shireenae (Hoser, 2003)

Genus *Python*

- Angolan Python, Python anchietae (Bocage, 1887)
  Borneo Short-tailed Python, Python breitensteini (Steindachner, 1881)
  Red Blood Python, Python brongersmai (Stull, 1938)
  Sumatran Short-tailed Python, Python curtus (Schlegel, 1872)
- Indian Python, Python molurus
  - Python molurus molurus (Linnaeus, 1758)
    Burmese Python, Python molurus bivittatus (Kuhl, 1820)
- South African Python, Python natalensis (Smith, 1833)
  Ball Python or Royal Python, Python regius (Shaw, 1802)
- Reticulated Python, Python reticulatus
  - Python reticulatus reticulatus (Schneider, 1801)
    Selayer Reticulated Python, Python reticulatus saputrai (Auliya, 2002)
    Kayaudi Dwarf Reticulated Python, Python reticulatus jampeanus (Auliya, 2002)
- African Rock Python, Python sebae (Gmelin, 1789)
  Timor Python, Python timoriensis (Peters, 1876)
-

Vipers

Viperidae

Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Class: Reptilia
Order: Squamata
Suborder: Serpentes
Family: **Viperidae,** Oppel, 1811
Synonyms

- *Viperae* - Laurenti, 1768
- *Viperini* - Oppel, 1811
- *Viperidae* - Gray, 1825[1]

The **Viperidae** are a family of venomous snakes commonly referred to as **vipers**, although the term **viperids** is more specific and distinguishes them from the viperines (subfamily Viperinae). These snakes are found all over the world, except in Australia and Madagascar. All have relatively long, hinged fangs that permit deep penetration and injection of venom. Four subfamilies are currently recognized.[2]

Contents

Description

All viperids have a pair of relatively long, solenoglyphous (hollow) fangs, that are used to inject venom from glands located towards the rear of the upper jaws. Each of the two fangs is located at the front of the mouth on a short maxillary bone that can rotate back and forth. When not in use, the fangs fold back against the roof of the mouth and are enclosed in a membranous sheath. The left and right fangs can be rotated together or independently. During a strike, the mouth can open nearly 180 degrees and the maxilla rotates forward, erecting the fang. The jaws close on impact and powerful muscles that surround the venom glands contract to inject the venom as the fangs penetrate. This action is lightning-fast and is more a stab than a bite. Viperids use this mechanism both to immobilize their prey and in self-defense.

Almost all vipers have keeled scales, a stocky build with a short tail and, due to the location of the venom glands, a triangular-shaped head distinct from the neck. Their eyes have vertically elliptical, or slit-shaped, pupils that can open wide to cover most of the eye or close almost completely, which helps them to see in a wide range of light levels. Typically, vipers are nocturnal, ambush predators.

Compared to many other snakes, vipers often appear rather sluggish. Most are ovoviviparous, giving birth to live young, but a few lay eggs. Indeed, the name of this group is derived from Latin (*vivo* = live, *parthus* = birth) and is in reference to the more common of these two reproductive modes.[3]

Venom

As opposed to the elapids, which produce mainly neurotoxic venom, viperid venoms are largely proteolytic, meaning that they rapidly destroy blood and tissue. This kind of venom is also dual-purpose. Most vipers have poor digestive systems and often rely on their venom not just to immobilize their prey, but also to aid in the digestion thereof: fluids in the stomach digest the meal from the outside in, while the venom digests it from the inside out.

There are, of course, always exceptions and a number of viperid species produce venom that is partially or even entirely neurotoxic, which can make them extremely dangerous. Examples are the tropical rattlesnakes (Crotalus durissus), some Mojave rattlesnakes (Crotalus scutulatus), and the rare mountain adder (Bitis atropos).

Due to the nature of proteolytic venom, a viperid bite is often a very painful experience and should always be taken seriously, even though it is not necessarily fatal. Even with prompt and proper treatment, a bite can still result in a permanent scar, and in the worst cases the affected limb may even have to be amputated. A victim's actual fate is impossible to predict as this depends on many factors, including (but not limited to) the species and size of the snake involved, how much venom was injected (if any) and the size and condition of the patient prior to being bitten. The patient may also be allergic to the venom and/or the antivenin.

Subfamilies

Subfamily [2	Authority [2	Genera [2]	Species [2]	Common name	Geographic range [1]
Azemiopinae	Liem, Marx & Rabb, 1971	1	1	Fea's viper	Myanmar, southeastern Tibet across southern China (Fujien,Guangxi,J to northern Vietnam.
Causinae	Cope, 1859	1	6	Night adders	Subsaharan Africa
Crotalinae	Oppel, 1811	18	151	Pit vipers	In the Old World from eastern Europe eastward through Asia to Japan, Taiwan, Indonesia, peninsular India and Sri Lanka. In the New World from southern Canada southward through Mexico and Central America to southern South America.
Viperinae	Oppel, 1811	12	66	True or pitless vipers	Europe, Asia and Africa.

Type genus = *Vipera* - Laurenti, 1768[1]

Taxonomy

That Viperidae is attributed to Oppel (1811), as opposed to Laurenti (1768) or Gray (1825), is subject to some interpretation. However, the consensus among leading experts is that Laurenti used *viperae* as the plural form of *vipera* (Latin for viper, adder or snake) and did not intend for it to indicate a a family group taxon. Rather, it is attributed to Oppel, based on his Viperini as a distinct family group name, despite the fact that Gray was the first to use the form Viperinae.[1]

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Pit vipers | True vipers

Pit vipers

Crotalinae

Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Class: Reptilia
Order: Squamata
Suborder: Serpentes
Family: Viperidae
Subfamily: **Crotalinae,** Oppel, 1811
Synonyms

- Crotalini - Oppel, 1811
- Crotales - Cuvier, 1817
- Crotalidae - Gay, 1825
- Crotaloidae - Fitzinger, 1826
- Cophiadae - Boie, 1827
- Crotaloidei - Eichwald, 1831
- Crotalina - Bonaparte, 1831
- Bothrophes - Fitzinger, 1843
- Crotalinae - Cope, 1860
- Teleuraspides - Cope, 1871
- Crotalida - Strauch, 1873
- Bothrophera - Garman, 1884
- Cophiinae - Cope, 1895
- Lachesinae - Cope, 1900
- Lachesinii - Smith, Smith & Sawin, 1977
- Agkistrodontinii - Hoge & Romano-Hoge, 1981
- Agkistrodontini - Hoge & Romano-Hoge, 1983[1]

Common names: pit-vipers.

The **Crotalinae**, or crotalines, are a subfamily of venomous vipers. They are distinguished by their heat-sensing pit organs located between the eye and the nostril on either side of the head. 18 genera are currently recognized:[2] 7 in the Old World and 11 in the New World.[1] These are the only viperids found in the Americas.

Contents

Description

Like all viperids, pit vipers all have a pair of relatively long, solenoglyphous (hollow) fangs that are used to inject mainly proteotoxic venom. The head has an obvious triangular shape and eyes have elliptical pupils. For further information, see *Viperidae*.

The pit organ is clearly visible between the eye and the nostril of this New Mexico ridge-nosed rattlesnake, *Crotalus willardi obscurus*.

Pit vipers are named after their specialized thermoreceptors: heat-sensitive organs located on either side of the head that look like small pits. These pits contain membranes sensitive to infrared radiation and allows the snakes to locate their prey based on temperature differences with their environment. To a pit viper, rodents and birds that are only fractionally warmer than the background stand out even in complete darkness. Like a primitive pair of eyes, these pits even give them depth perception, allowing them to strike accurately under such conditions. Since the crotalines, like most other viperids, are nocturnal ambush predators, this adaptation serves them particularly well. In an example of parallel evolution, only the boids have developed similar heat-sensitive organs.

Crotalines range in size from small, such as the eyelash viper, Bothriechis schlegelii, with a maximum of 50 cm (20 inches), to the bushmaster, Lachesis muta, that grows to an imposing 3.5 metres (11.5 feet) and is the longest viper in the world.

Geographic range

This family of snakes is found in the Old World from eastern Europe eastward through Asia to Japan, Taiwan, Indonesia, peninsular India and Sri Lanka. In the Americas, they range from southern Canada southward through Mexico and Central America to southern South America.[1]

Habitat

Pit Vipers are a versatile group, with members found in habitats ranging from parched desert (e.g., rattlesnakes) to rainforests (e.g., the fer-de-lance, Bothrops atrox) and even aquatic settings (e.g., the water moccasin, Agkistrodon piscivorus). Species may be either arboreal or terrestrial, and some can even be found at elevations exceeding 1,000 metres.

Behavior

Although a few species are highly active by day, such as Trimeresurus trigonocephalus, a bright green pit viper endemic to Sri Lanka, most are nocturnal, preferring to avoid scorching daytime temperatures and to hunt when their favored prey are also active. The snakes' heat-sensitive pits are also thought to aid in locating cooler areas in which to rest.

As ambush predators, crotalines will typically wait patiently somewhere for unsuspecting prey to wander by. At least one species, the arboreal Gloydius shedaoensis of China, is known to select a specific ambush site and return to it every year in time for the spring migration of birds. Studies have indicated that these snakes learn to improve their strike accuracy over time.[3]

Many temperate species (e.g. most rattlesnakes) will congregate in sheltered areas or *dens* to overwinter (see hibernation), the snakes benefitting from the combined heat. In cool temperatures and while pregnant vipers also bask on sunny ledges. Some species do not mass together in this way, such as the copperheads, Agkistrodon contortrix, and the Mojave rattlesnake, Crotalus scutulatus.

Like most snakes, crotalines keep to themselves and will strike only if cornered or threatened. Smaller snakes are less likely to stand their ground than are larger specimens. Pollution and the destruction of rainforests has caused many viper populations to decline. Humans also threaten vipers, as many vipers are hunted for their skins or killed by cars when they wander onto roads.

Reproduction

With few exceptions, crotalines are ovoviviparous; that is, females give birth to live young. Among the oviparous (egg-laying) pit vipers are Lachesis, Calloselasma, and some Trimeresurus species. It is believed that all egg-laying crotalines guard their eggs.

Brood sizes range from two for very small species, to as many as 86 for the fer-de-lance, *Bothrops atrox*: a species among the most prolific of all live-bearing snakes. Many young crotalines have brightly coloured tails that contrast dramatically with the rest of their bodies. Used in a behavior known as caudal luring, the young snakes make worm-like movements with their tails to lure unsuspecting prey within striking distance.

Genera

Genus [2]	Authority [2	Species [2]	Subsp.* [2]	Common name	Geographic range [1]
Agkistrodon	Palisot de Beauvois, 1799	3	9	Moccasins	North America from the northeastern and central USA southward through peninsular Florida and southwestern Texas. In Central America on the Atlantic versant from Tamaulipas and Nuevo León southward to the Yucatan Peninsula, Belize and Guatamala. Along the Pacific coastal plane and lower foothills from Sonora south through Guatamala, El Salvador,

					Honduras and Nicaragua to northwestern Costa Rica.
Atropoides	Werman, 1992	3	2	Jumping vipers	The mountains of eastern Mexico southeastward on the Atlantic versant and lowlands though Central America to central Panama. On the Pacific versant, they occur in isolated populations in east-central and southern Mexico, Guatamala, El Salvador, Costa Rica and Panama.
Bothriechis	Peters, 1859	7	0	Palm vipers	Southern Mexico (southeastern Oaxacaand the northern highlands of

					Chiapas), through Central America to northern South America (Colombia, western Venezuela, Ecuador and northern Peru.
Bothriopsis	Peters, 1861	7	2	Forest vipers	Eastern Panama and most of northern South America, including the Pacific lowlands of Colombia and Ecuador, the Andes Mountains from Venezuela and Colombia to Bolivia, the Amazon Basin and the Atlantic forests of Brazil.
Bothrops	Wagler, 1824	32	11	Lanceheads	Northeastern Mexico (Tamaulipas) southward through

					Central and South America to Argentina; Saint Lucia and Martinique in the Lesser Antilles; Ilha da Queimada Grande off the coast of Brazil.
Calloselasma	Cope, 1860	1	0	Malayan pit viper	Southeast Asia from Thailand to northern Malaysia and Java, Indonesia.
Cerrophidion	Campbell & Lamar, 1992	3	0	Montane pit vipers	Southern Mexico (highlands of Guerrero and southeastern Oaxaca), southward through the highlands of Central America (Guatamala, El Salvador, Honduras, northern Nicaragua, Costa Rica) to western Panama.
Crotalus[T]	Linnaeus,	27	43	Rattlesnakes	The

	1758				Americas, from southern Canada to northern Argentina.
Deinagkistrodon	Gloyd, 1979	1	0	Hundred-pace viper	Southeast Asia.
Gloydius	Hoge & Romano-Hoge, 1981	9	9		Russia, east of the Ural Mountains through Siberia, Iran, the Himalayas from Pakistan, India, Nepal and China, Korea, Japan and the Ryukyu Islands.
Hypnale	Fitzinger, 1843	3	0	Humpnose vipers	Sri Lanka and India.
Lachesis	Daudin, 1803	3	1	Bushmasters	Central and South America.
Ophryacus	Cope, 1887	2	0	Mexican pit vipers	Mexico.
Ovophis	Burger, 1981	3	3	Asian mountain vipers and South Asian pit vipers	Nepal and Seven Sisters (Assam) eastward through Myanmar, Cambodia, Thailand, Laos, Vietnam, West Malaysia,

					Taiwan, Japan (Okinawa) and Indonesia (Sumatra and Borneo).
Porthidium	Cope, 1871	7	3	Hognose pit vipers	Mexico (Colima, Oaxaca and Chiapas on the Pacific side, the Yucatan Peninsula on the Atlantic side) southward through Central America to northern South America (Ecuador in the Pacific lowlands, northern Venezuela in the Atlantic lowlands).
Sistrurus	Garman, 1883	3	7	Massasaugas and pigmy rattlesnakes	Southeastern Canada, eastern and northwestern USA, isolated populations in northern and central Mexico.

Trimeresurus	Lacépède, 1804	35	11	Asian pit vipers and palm vipers	Southest Asia from India to southern China and Japan, and the Malay Archipelago to Timor.
Tropidolaemus	Wagler, 1830	2	0	Temple vipers	Southern India and Southeast Asia.

**) Not including the nominate subspecies (typical form).*
T) Type genus.[1]

Taxonomy

In the past, the pit vipers were usually classed as a separate family: the *Crotalidae*. Today, however, the monophyly of the viperines and the crotalines as a whole is undisputed, which is why they are treated here as a subfamily of the *Viperidae*.

See also

- List of rattlesnake species and subspecies.
- Rattlesnakes.

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Rattlesnake

Rattlesnake

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Squamata
Suborder: Serpentes
Family: Viperidae
Subfamily: Crotalinae
Genus: ***Crotalus,*** Linnaeus, 1758
Genus: ***Sistrurus,*** Garman, 1883
Species: 27 species

Rattlesnakes are a group of venomous New World snakes, genera ***Crotalus*** and ***Sistrurus***. They belong to the class of venomous snakes known commonly as pit vipers.

Contents

Overview

There are nearly thirty species of rattlesnake, with numerous subspecies. They are named for the rattle found at the tip of their tails that is used as a warning device when threatened. The scientific name Crotalus derives from the Greek, ºÁ¿Ä±»¿½, meaning "castanet". The name Sistrurus shares its root with the ancient Egyptian musical instrument, the sistrum, a type of rattle. Most rattlesnakes mate in the spring, and all species give live birth. Mothers care for their young after birth for seven to ten days.

Prey

Rattlesnakes feed on rodents and other small animals, subduing their prey by striking them quickly with a venomous bite as opposed to constricting. The venom stuns and/or kills typical rattlesnake prey immediately. A rattlesnake will follow a larger animal that does not quickly succumb to the venom and attempts to escape.

Rattle

The rattle is composed of a series of nested, hollow beads which are actually modified scales from the tail tip. Each time the snake sheds its skin, a new rattle segment is added. Since they may shed their skins several times a year depending on food supply and growth rates and since the rattle can and does break, there is a little truth to the claim that one can tell a rattlesnake's age from the number of beads in its rattle. Newborn rattlesnakes do not have functional rattles; it isn't until after they have shed their skin for the first time that they gain an additional bead, which beats against the first bead, known as the button, to create the rattling sound. Adult snakes may lose their rattles on occasion, but more appear at each molting. In wet weather if the rattle has absorbed sufficient water, it will not make noise.

Even with a useable rattle, a rattlesnake might not always give warning. Some speculate that rattlesnakes that use their rattles around humans are often killed and natural selection may favor rattlesnakes that do not give advance warning.

Paleontology

The earliest fossil found which can be definitively identified as a rattlesnake was discovered near Driftwood Creek in Hitchcock County, Nebraska, USA. An exact age of the specimen is indeterminate, but it is estimated to be anywhere from between 4 to 12 million years old. The fossilized remains of rattlesnakes usually include vertebrae and ribs, which makes accurate species identification virtually impossible, as even many species of modern rattlesnakes have near identical vertebral characteristics. One extinct species, of which fossils were discovered in Allen Cave in Citrus County, Florida, was given the name *Crotalus giganteus*. Though it had many characters in common with the modern *Crotalus adamanteus*, it was a much larger animal, probably attaining lengths in excess of 12 feet. In general, the fossil record for rattlesnakes is quite limited, and their exact route of evolution from the more "primitive" true vipers to their current form is not well understood.[1]

Safety and identification

Different species of rattlesnake vary significantly in size, territory, markings, and temperament. If the rattlesnake is not cornered or imminently threatened, it will usually attempt to flee from encounters with humans, but will not always do so. Bites often occur when humans startle the snake or provoke it. Those bitten while provoking rattlesnakes have usually underestimated the range(roughly two-thirds of its total length) and speed with which a coiled snake can strike(almost literally faster than the human eye can follow). Be aware that they can actually strike without pulling their body back into the famous "S" coil shape first and they may strike without any warning if feeling threatened. Heavy boots and long pants reinforced with leather or canvas are recommended when hiking in areas known to harbor rattlesnakes.

For learning how to quickly and safely identify rattlesnakes by their markings, guides are available through booksellers, libraries, and local conservation and wildlife management agencies. The best way to avoid contact with rattlesnakes is to remain observant and avoid potential encounters. Hikers should always watch their steps when negotiating fallen logs or boulders and take extra caution when near rocky outcroppings and ledges where rattlesnakes may be hiding or sunning themselves. Snakes will occasionally sun themselves in the middle of a trail, so always watch your step. When encountering a rattlesnake on a trail, keep your distance and allow the snake room to retreat. Pets should be kept leashed to prevent them from provoking a rattlesnake.

Rattlesnake bites

Rattlesnakes are born with fully functioning fangs capable of injecting venom and can regulate the amount of venom they inject when biting. Generally they deliver a full dose of venom to their prey, but may deliver less venom or none at all when biting defensively. A frightened or injured snake may not exercise such control. Additionally, young snakes may have not yet learned to control the amount of venom they deliver. Some studies contest that young snakes may be capable of injecting less venom, and the high toxicity of their bite comes from a variation in their venom which causes it to have a more potent concentration than in their adult counterparts. Any bite from a rattlesnake should be considered fully venomous and those bitten should seek medical attention immediately.

Toxicity

Most species of rattlesnakes have hemotoxic venom, destroying tissue, degenerating organs and disrupting blood clotting. Rattlesnakes have the most potent hemotoxic venom of any snake, making them one of the most dangerous snakes in the world. A few other snakes have stronger venom, but the large amounts of venom rattlers can inject makes their bites one of the worst. Some degree of permanent scarring is very likely in the event of a venomous bite, even with prompt, effective treatment, and a severe envenomation, combined with delayed or ineffective treatment, can lead to the loss of a limb and usually death. Thus, a rattlesnake bite is always a potentially serious, or even fatal, injury. Untreated rattlesnake bites, especially from larger species, are usually fatal. However, antivenom, when applied in time, reduces the death rate to less than 4%. Around 8,000 people are bitten by poisonous snakes in the United States each year. On average, fewer than 15 snakebite deaths are reported.

The venom of the Mojave Rattler is the most potent - its venom is 30 - 50 times as powerful as an Indian Cobra, and posesses a venom that drop for drop is nearly as powerful as the most virulent Australian species of snakes. Large Diamondback rattlers, while having considerably less potency by volume than other species such as the Mojave or Midget Faded rattlesnakes, possess a large enough volume of venom to kill several hundred humans. Diamondback Rattlesnake rank near the very top of most dangerous snakes in the world.

Some rattlesnakes, especially the tropical species, have neurotoxic

venom. A bite from these snakes can interfere with the function of the heart, paralyze the lungs, and shut down parts of the nervous system. Bites by neurotoxic species such as the Mojave Rattlesnake should be field treated by wrapping the bitten area with an elastic bandage to impede the spread of the poison for as long as possible. This is not a tourniquet, and should be wrapped only as tightly as one would wrap a sprain (it should be possible to slip a finger between the bandage and the limb). The goal is to impede the subcutaneous circulation of the venom. Tourniquets are not recommended for any type of snakebite.

First aid

When a bite occurs, the amount of venom injected cannot be gauged easily. Symptoms and swelling may occur quickly, but in some cases hours may pass before serious effects appear.

Experienced health workers typically gauge envenomation in stages ranging from 0, when there is no evident venom, to 5, when there is a life-threatening amount of venom present. The stages reflect the amount of bruising and swelling around the fang marks and the speed with which that bruising and swelling progresses. In more severe envenomation cases (stage 4 or 5) there may also be proximal symptoms, such as lip-tingling, dizziness, bleeding, vomiting, or shock. Difficulty breathing, paralysis, drooling, and massive hemmorhaging are also common symptoms.

Quick medical attention is critical, and treatment typically requires antivenin/antivenom to block the tissue destruction, nerve effects, and blood-clotting disorders common with rattlesnake venom. Most medical experts recommend keeping the area of the bite below the level of the heart. It is important to keep a snake bite victim calm in order to avoid elevating their heart rate and accelerating the circulation of venom within the body. Untrained individuals should not attempt to make incisions at or around bite sites, or to use tourniquets, as either treatment may be more destructive than the envenomation itself.

Rattlesnakes as food

Rattlesnakes are also a popular food in some southwestern cuisines and is sometimes sold in specialty meat shops. It has a flavor reminiscent of free range chicken and a chewy texture similar to alligator.

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List of rattlesnake species and subspecies

List of rattlesnake species and subspecies

Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Class: Reptilia
Order: Squamata
Suborder: Serpentes
Family: Viperidae
Subfamily: Crotalinae
Genus: ***Crotalus* / *Sistrurus***

This **list of rattlesnake species and subspecies** includes the genera *Crotalus*[1] and *Sistrurus*.[2] It follows the taxonomy currently provided by ITIS, which is based on the continuing work of Dr. Roy McDiarmid.[3]

Crotalus

- Crotalus adamanteus, Eastern diamondback rattlesnake
  Crotalus aquilus, Queretaran dusky rattlesnake
  Crotalus atrox, Western diamondback rattlesnake
  Crotalus basiliscus, Basilisk rattlesnake
  Crotalus catalinensis, Catalina island rattlesnake
- Crotalus cerastes - Sidewinders
  - Crotalus cerastes cerastes, Mojave desert sidewinder
    Crotalus cerastes cercobombus, Sonoran desert sidewinder
    Crotalus cerastes laterorepens, Colorado desert sidewinder
- Crotalus durissus - Tropical rattlesnakes
  - Crotalus durissus cascavella, Northeastern Brazilian rattlesnake
    Crotalus durissus collilineatus, Central Brazilian rattlesnake
    Crotalus durissus culminatus, Northwestern neotropical rattlesnake
    Crotalus durissus cumanensis, Venezuelan rattlesnake
    Crotalus durissus dryinus, Guianian rattlesnake
    Crotalus durissus durissus, Cascabel rattlesnake
    Crotalus durissus marajoensis, Marajoan rattlesnake
    Crotalus durissus ruruima, Mt. Roriama rattlesnake
    Crotalus durissus terrificus, South American rattlesnake
    Crotalus durissus totonacus, Totonacan rattlesnake
    Crotalus durissus trigonicus, Rupunini rattlesnake
    Crotalus durissus tzabcan, Yucatan neotropical rattlesnake
- Crotalus enyo - Baja rattlesnakes
  - Crotalus enyo cerralvensis, Cerralvo island diamond rattlesnake
    Crotalus enyo enyo, Baja California rattlesnake
    Crotalus enyo furvus, Rosario rattlesnake
- Crotalus horridus - Timber rattlesnake
- Crotalus intermedius - Small-headed rattlesnakes
  - Crotalus intermedius gloydi, Oaxacan small-headed rattlesnake
    Crotalus intermedius intermedius, Totalcan small-headed rattlesnake
    Crotalus intermedius omiltemanus, Omilteman small-headed rattlesnake
- Crotalus lannomi, Autlan rattlesnake
- Crotalus lepidus - Rock rattlesnakes
  - Crotalus lepidus klauberi, Banded Rock rattlesnake

    - Crotalus lepidus lepidus, Mottled Rock rattlesnake
    - Crotalus lepidus maculosus, Durango Rock rattlesnake
    - Crotalus lepidus morulus, Tamaulipan Rock rattlesnake
- Crotalus mitchellii - Speckled rattlesnakes
    - Crotalus mitchellii angelensis, Angel de la Guarda island speckled rattlesnake
    - Crotalus mitchellii mitchellii, San Lucan speckled rattlesnake
    - Crotalus mitchellii muertensis, El Muerto island rattlesnake
    - Crotalus mitchellii pyrrhus, Southwestern speckled rattlesnake
    - Crotalus mitchellii stephensi, Panamint rattlesnake
- Crotalus molossus - Black-tailed rattlesnakes
    - Crotalus molossus estebanensis, San Esteban island black-tailed rattlesnake
    - Crotalus molossus molossus, Northern black-tailed rattlesnake
    - Crotalus molossus nigrescens, Mexican black-tailed rattlesnake
    - Crotalus molossus oaxacus, Oaxacan black-tailed rattlesnake
- Crotalus oreganus, Western Rattlesnakes
    - Crotalus oreganus abyssus, Grand Canyon rattlesnake
    - Crotalus oreganus caliginis
    - Crotalus oreganus cerberus, Arizona black rattlesnake
    - Crotalus oreganus concolor, Midget faded rattlesnake
    - Crotalus oreganus helleri, Southern Pacific rattlesnake
    - Crotalus oreganus lutosus, Great Basin rattlesnake
    - Crotalus oreganus oreganus, Northern Pacific rattlesnake
- Crotalus polystictus, Mexican lancehead rattlesnake
- Crotalus pricei - Twin-spotted rattlesnakes
    - Crotalus pricei miquihuanus, Eastern twin spotted rattlesnake
    - Crotalus pricei pricei, Western twin spotted rattlesnake
- Crotalus pusillus, Tancitaran dusky rattlesnake
- Crotalus ruber - Red diamond rattlesnakes
    - Crotalus ruber lorenzoensis, San Lorenzo island diamond rattlesnake
    - Crotalus ruber lucansensis, San Lucan island diamond rattlesnake
    - Crotalus ruber ruber, Red diamond rattlesnake
- Crotalus scutulatus - Mojave rattlesnakes
    - Crotalus scutulatus salvini, Humantlan rattlesnake

    - Crotalus scutulatus scutulatus, Mojave rattlesnake
- Crotalus stejnegeri, Long-tail rattlesnake
  Crotalus tigris, Tiger rattlesnake
  Crotalus tortugensis, Tortuga island diamond rattlesnake
  Crotalus transversus, Cross-banded mountain rattlesnake
- Crotalus triseratus - Dusky rattlesnake
    - Crotalus triseratus armstrongi, Mexican dusky rattlesnake
      Crotalus triseratus triseratus, Central plateau dusky rattlesnake
- Crotalus viridis - Prairie Rattlesnakes
    - Crotalus viridis nuntius, Hopi rattlesnake
      Crotalus viridis viridis, Prairie rattlesnake
- Crotalus willardi - Ridge-nosed rattlesnakes
    - Crotalus willardi amabilis, Del Nido ridge-nosed rattlesnake
      Crotalus willardi meridionalis, Southern ridge-nosed rattlesnake
      Crotalus willardi obscurus, New Mexican ridge-nosed rattlesnake
      Crotalus willardi silus, Western Chihuahuan ridge-nosed rattlesnake
      Crotalus willardi willardi, Arizona ridge-nosed rattlesnake

Sistrurus

- Sistrurus catenatus - Massasaugas
    - Sistrurus catenatus catenatus, Eastern massasauga
      Sistrurus catenatus edwardsii, Desert massasauga
      Sistrurus catenatus tergiminus, Western massasauga
- Sistrurus miliarius - Pygmy rattlesnakes
    - Sistrurus miliarius barbouri, Dusky pygmy rattlesnake
      Sistrurus miliarius miliarius, Carolina pygmy rattlesnake
      Sistrurus miliarius streckeri, Western pygmy rattlesnake
- Sistrurus ravus - Mexican pygmy rattlesnakes
    - Sistrurus ravus brunneus, Oaxacan pygmy rattlesnake
      Sistrurus ravus exigus, Guerreran pygmy rattlesnake
      Sistrurus ravus ravus, Central Plateau pygmy rattlesnake

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3. ^ McDiarmid RW, Campbell JA, Touré T. 1999. Snake Species of the World: A Taxonomic and Geographic Reference, vol. 1. Herpetologists' League. 511 pp. ISBN 1-893777-00-6 (series). ISBN 1-893777-01-4 (volume).

True vipers

Viperinae

Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Class: Reptilia
Order: Squamata
Suborder: Serpentes
Family: Viperidae
Subfamily: **Viperinae,** Oppel, 1811
Synonyms

- Viperini - Oppel, 1811
- Viperes - Cuvier, 1817
- Viperides - Latreille, 1825
- Viperina - Gray, 1825
- Viperiodea - Fitzinger, 1826
- Viperiodei - Eichwald, 1831
- Viperinae - Cantor, 1847
- Viperiformes - Günther, 1864
- Viperida - Strauch, 1869[1]

Common names: pitless vipers, true vipers, Old World vipers.[2]

The **Viperinae**, or viperines, are a subfamily of venomous vipers found in Europe, Asia and Africa. They are distinguished by their lack of the heat-sensing pit organs that characterize their sister group, the Crotalinae. Currently, 12 genera and 66 species are recognized.[3] Most are tropical and subtropical, although one species, Vipera berus, even occurs within the Arctic Circle.[2]

Contents

Description

Members of this subfamily range in size from Bitis schneideri, that grows to a maximum of 28 cm, to Bitis gabonica that reaches a maximum length of over 2 m. Most species are terrestrial, but a few, such as Atheris, are completely arboreal.[2]

Although the heat-sensing pits that characterize the Crotalinae are clearly lacking in the viperines, a supernasal sac with sensory function has been described in a number of species. This sac is an invagination of the skin between the supranasal and nasal scales and is connected to the ophthalmic branch of the trigeminal nerve. The nerve endings here resemble those in the labial pits of boas. The supernasal sac is present in Daboia, Pseudocerastes and Causus, but is especially well developed in Bitis. Experiments have shown that strikes are not only guided by visual and chemical cues, but also by heat, with warmer targets being struck more frequently than colder ones.[2]

Geographic range

Europe, Asia and Africa.[1] However, they do not occur in Madagascar.[4]

Reproduction

Generally, members of this subfamily are viviparous (ovoviviparous), although a few, such as Pseudocerastes, lay eggs.[2]

Genera

Genus[3]	Species	Subsp.*	Common name	Geographic range[1]
Adenorhinos	1	0	Uzungwe viper	Central Tanzania: Udzungwe and Ukinga Mountains.
Atheris	8	1	Bush vipers	Tropical subsaharan Africa, excluding southern Africa.
Bitis	14	2	Puff adders	Africa and the southern Arabian Peninsula.
Cerastes	3	0	Desert vipers	North Africa eastward through Arabia and Iran.
Daboia	1	1	Russell's viper	Pakistan, India, Sri Lanka, Bangladesh, Nepal, Myanmar, Thailand, Cambodia, China (Kwangsi and Kwantung), Taiwan and Indonesia (Endeh, Flores, east Java, Komodo, Lomblen Islands).

Echis	8	6	Saw-scaled vipers	India and Sri Lanka, parts of the Middle East and Africa north of the equator.
Eristicophis	1	0	McMahon's viper	The desert region of Balochistan near the Iran-Afghanistan-Pakistan border.
Macrovipera	4	4	Large Palearctic vipers	Semideserts and steppes of northern Africa, the Near and Middle East, and the Milos Archipelago in the Aegean Sea.
Montatheris	1	0	Montane viper	Kenya: moorlands of the Aberdare range and Mount Kenya above 3000 m.
Proatheris	1	0	Lowland viper	Floodplains from southern Tanzania (northern end of Lake Malawi) through Malawi to near Beira, central Mozambique.
Pseudocerastes	1	2	Horned vipers	From the Sinai of Egypt

				eastward to Pakistan.
Vipera[T]	23	12	Palearctic vipers	Great Britain and nearly all of continental Europe across the Arctic Circleand on some islands in the Mediterranean (Elba, Montecristo, Sicily) and Aegean Sea eastward across northen Asia to Sakhalin Island and North Korea. Also found in northern Africa in Morocco, Algeria and Tunisia.

**) Not including the nominate subspecies (typical form).*

T) Type genus.

Tribes

One tribe is currently recognized, Atherini, created by Broadley in 1996 to describe the genera Atheris, Adenorhinos, Montatheris and Proatheris. The type genus for this tribe is *Atheris*.[1]

Closely related groups

Until relatively recently, two other genera were also included in the Viperinae. However, they were eventually considered so distinctive within the Viperidae, that separate subfamilies were created for them:[1]

- Genus *Azemiops* - moved to subfamily *Azemiopinae* by Liem, Marx & Rabb (1971).
- Genus *Causus* - recognition of subfamily *Causinae* (Cope, 1860) was proposed by Groombridge (1987) and further supported by Cadle (1992).

Nevertheless, these groups, together with the genera currently recognized as belonging to the Viperinae, are still often referred to collectively as the true vipers.[2]

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List of viperine species and subspecies | Vipera

List of viperine species and subspecies

Viperinae

Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Class: Reptilia
Order: Squamata
Suborder: Serpentes
Family: Viperidae
Subfamily: **Viperinae,** Oppel, 1811

This is a list of all species and subspecies of the subfamily **Viperinae**, otherwise referred to as the true vipers, the pitless vipers or the Old World vipers.

- Adenorhinos barbouri, Uzungwe mountain bush viper
  Atheris anisolepis
  Atheris ceratophora, Horned bush viper
  Atheris chlorechis, Western bush viper
  Atheris desaixi, Mount Kenya bush viper
  Atheris hispida, Bristly bush viper
  Atheris katangensis, Katanga mountain bush viper
- *Atheris nitschei*, Great Lakes bush viper
    - Atheris nitschei nitschei, Great Lakes bush viper
      Atheris nitschei rungweensis, Rungwe bush viper
- *Atheris squamigera*, Rough-scaled bush viper
- *Bitis arietans*, Puff adder
    - Bitis arietans arietans, Puff adder
      Bitis arietans somalica, Somali puff adder
- Bitis atropos, Mountain adder
  Bitis caudalis, Horned adder
- *Bitis cornuta*, Many-horned adder
    - Bitis cornuta albanica, Albany adder
      Bitis cornuta cornuta, Many-horned adder
- *Bitis gabonica*, Gaboon viper
    - Bitis gabonica gabonica, East African gaboon viper
      Bitis gabonica rhinoceros, West African gaboon viper
- Bitis heraldica, Angolan adder
  Bitis inornata, Plain mountain adder
  Bitis nasicornis, Rhinoceros viper

Bitis parviocula, Ethiopian viper
Bitis peringueyi, Peringuey's desert adder
Bitis rubida, Red adder
Bitis schneideri, Namaqua dwarf adder
Bitis worthingtoni, Kenyan horned viper
Bitis xeropaga, Desert mountain adder
Cerastes cerastes, Saharan horned viper
Cerastes gasperettii, Arabian horned viper
Cerastes vipera, Sahara sand viper

- *Daboia russelii*, Russell's viper
    - Daboia russelii russelii, Indian Russell's viper
      Daboia russelii siamensis, Eastern Russell's viper
- *Echis carinatus*, Saw-scaled viper
    - Echis carinatus astolae
      Echis carinatus carinatus, Saw-scaled viper
      Echis carinatus multisquamatus, Central Asian saw-scaled viper
      Echis carinatus sinhaleyus
      Echis carinatus sochureki
- Echis coloratus, Painted saw-scaled viper
  Echis hughesi, Hughes' saw-scaled viper
  Echis jogeri, Joger's saw-scaled viper
  Echis leucogaster, White-bellied saw-scaled viper
  Echis megalocephalus, Cherlin's saw-scaled viper
  Echis ocellatus, West African saw-scaled viper
- *Echis pyramidum*, Egyptian saw-scaled viper
    - Echis pyramidum aliaborri
      Echis pyramidum leakeyi
      Echis pyramidum pyramidum, Egyptian saw-scaled viper
- Eristicophis macmahonii, McMahon's desert viper
  Macrovipera deserti, Desert viper
- *Macrovipera lebetina*, Blunt-nosed viper
    - Macrovipera lebetina cernovi
      Macrovipera lebetina lebetina, Blunt-nosed viper
      Macrovipera lebetina obtusa
      Macrovipera lebetina transmediterranea
      Macrovipera lebetina turanica
- Macrovipera mauritanica, Moorish viper
  Macrovipera schweizeri, Milos viper
  Montatheris hindii, Montane viper
  Proatheris superciliaris, Lowland swamp viper
- *Pseudocerastes persicus*, Persian horned viper
    - *Pseudocerastes persicus fieldi*, Field's horned viper
- Vipera albicornuta, Iranian mountain viper

Vipera albizona, Central Turkish mountain viper

- *Vipera ammodytes*, Horned viper
    - Vipera ammodytes ammodytes, Horned viper
      Vipera ammodytes gregorwallneri
      Vipera ammodytes meridionalis
      Vipera ammodytes montandoni
      Vipera ammodytes transcaucasiana, Transcaucasian sand viper
- *Vipera aspis*, Asp viper
    - Vipera aspis aspis, Asp viper
      Vipera aspis atra
      Vipera aspis francisciredi
      Vipera aspis hugyi
      Vipera aspis zinnikeri
- *Vipera barani*, Baran's adder
- *Vipera berus*, Common European adder
    - Vipera berus berus, Common European adder
      Vipera berus bosniensis
      Vipera berus sachalinensis
- Vipera bornmuelleri, Bornmuellers viper
  Vipera bulgardaghica, Bulgardagh viper
  Vipera darevskii, Darevsky’s viper
  Vipera dinniki, Dinnik’s viper
  Vipera kaznakovi, Caucasus viper
- *Vipera latastei*, Lataste's viper
    - Vipera latastei gaditana
      Vipera latastei latastei, Lataste's viper
- Vipera latifii, Latifi's viper
  Vipera lotievi, Caucasian meadow viper
  Vipera monticola, Atlas mountain viper
  Vipera nikolskii, Nikolski’s viper
  Vipera palaestinae, Palestine viper
  Vipera pontica, Pontic adder
  Vipera raddei, Rock viper
- *Vipera seoanei*, Baskian viper
    - Vipera seoanei cantabrica
      Vipera seoanei seoanei, Baskian viper
- Vipera ursinii, Meadow viper
  Vipera wagneri, Ocellated mountain viper
  Vipera xanthina, Rock viper

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Vipera

Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Class: Reptilia
Order: Squamata
Suborder: Serpentes
Family: Viperidae
Subfamily: Viperinae
Genus: ***Vipera,*** Laurenti, 1768

Synonyms

- *Vipera* - Laurenti, 1768
- *Pelias* - Merrem, 1820
- *Chersea* - Fleming, 1822
- *Rhinaspis* - Bonaparte, 1834
- *Rhinechis* - Fitzinger, 1843
- *Echidnoides* - Mauduyt, 1844
- *Mesocoronis* - Reuss, 1927
- *Teleovipera* - Reuss, 1927
- *Acridophaga* - Reuss, 1927
- *Mesovipera* - Reuss, 1927
- *Mesohoronis* - Reuss, 1927
- *Mesohorinis* - Reuss, 1927
- *Latastea* - Reuss, 1929
- *Tzarevcsya* - Reuss, 1929
- *Latasteopara* - Reuss, 1935[1]

Common names: Palaearctic vipers,[2] Eurasian vipers.[3]

Vipera is a genus of venomous vipers. It has a very wide range, being found from from North Africa to just withing the Arctic Circle and from the British Isles to Pacific Asia.[2] 23 species are currently recognized.[4]

Contents

Description

Members are usually small and more or less stoutly built. The head is distinct from the neck and covered with small scales in many species, although some have a few small plates on top. The dorsal scales are strongly keeled, the anal scale is divided and the subcaudals paired.[2]

Geographic range

They can be found in Great Britain and nearly all of continental Europe, on some small islands of the Mediterranean (Elba, Montecristo, Sicily) and the Aegean Sea, as well as in northern Africa in Morocco, Algeria and Tunisia. It also occurs across the Arctic Circle and eastwards though northern Asia to Sakhalin Island and northern Korea. [1]

Habitat

Most species prefer cooler environments. Those found at lower latitudes tend to prefer higher altitudes and dryer, rocky habitats, while the species that occur at more northern latitudes prefer lower elevations and environments that have more vegetation and moisture. [2]

Behavior

All species are terrestrial.[2]

Reproduction

All members are viviparous, giving birth to live young.[2]

Venom

Most *Vipera* species have venom that contains both neurotoxic and hemotoxic components. Bites vary widely in severity. Smaller, northern species, such as V. berus, have only slightly less toxic venom, but inject very little. Others, such as V. ammodytes, are capable of injecting much more with devastating results. However, bites from Vipera species are rarely as severe as those from larger Macrovipera or Daboia.[2]

Species

Species[1]	Subsp.*	Common name	Geographic range[1]
V. albicornuta	0	Iranian mountain viper	The Zanjan Valley and surrounding mountains in northwestern Iran.
V. albizona	0	Central Turkish mountain viper	Central Turkey.
V. ammodytes	4	Horned viper	North-eastern Italy, southern Slovakia, western Hungry, Slovenia, Croatia, Bosnia-Herzegovina, Serbia, Montenegro, Albania, Greece (including Macedonia and Cyclades), Romania, Bulgaria, Turkey, Georgia and Syria.
*V. aspis*T	4	Asp viper	France, Andorra, northeastern Spain, extreme southwestern Germany, Switzerland, Monaco, the islands of Elba and Montecristo, Sicily, Italy, San Marino and northwestern Slovenia.
V. barani	0	Baran's adder	Northwestern

			Turkey.
V. berus	2	Common European adder	From western Europe (Great Britain, Scandinavia, France) across central (Italy, Albania, Bulgaria and northern Greece) and eastern Europe to north of the Arctic Circle, and Russia to the Pacific Ocean, Sakhalin Island, North Korea, northern Mongolia and northern China.
V. bornmuelleri	0	Bornmuellers viper	Golan Heights, southern Lebanon and Syria.
V. bulgardaghica	0	Bulgardagh viper	The Bulgar Dagh (Bolkar Dagi) mountains, Nigde Province, south central Anatolia, Turkey.
V. darevskii	0	Darevsky's viper	The southeastern Dzavachet Mountains in Armenia and adjacent areas in Georgia.
V. dinniki	0	Dinnik's viper	Russia (Great Caucasus) and Georgia (high mountain basin of the Inguri River), eastward to Azerbaijan.
V. kaznakovi	0	Caucasus viper	Northeastern

			Turkey, Georgia and Russia (eastern Black Sea coast.
V. latastei	1	Lataste's viper	Extreme southwestern Europe (France, Portugal and Spain) and northwestern Africa (the Mediterranean region of Morocco, Algeria and Tunisia).
V. latifii	0	Latifi's viper	Iran: upper Lar Valley in the Elburz Mountains.
V. lotievi	0	Caucasian meadow viper	The higher range of the Big Caucasus: Russia, Georgia and Azerbaijan.
V. monticola	0	Atlas mountain viper	High Atlas Mountains, Morocco.
V. nikolskii	0	Nikolsky's viper	Central Ukraine.
V. palaestinae	0	Palestine viper	Syria, Jordan, Israel and Lebanon.
V. pontica	0	Pontic adder	Known only from the Coruh valley in Artvin Province, northeastern Turkey.
V. raddei	0	Rock viper	Eastern Turkey, northwestern Iran, Armenia, Azerbaijan, and probably Iraq.
V. seoanei	1	Baskian viper	Extreme southwestern

			France and the northern regions of Spain and Portugal.
V. ursinii	0	Meadow viper	Southeastern France, eastern Austria (extinct), Hungary, central Italy, Croatia, Bosnia-Herzegovina, northern and northeastern Albania, Romania, northern Bulgaria, Greece, Turkey, northwestern Iran, Armenia, Azerbaijan, Georgia, Russia and across the Khazakstan, Kirgizia and eastern Uzbekistan steppes to China (Xinjiang).
V. wagneri	0	Ocellated mountain viper	The mountains of eastern Turkey and adjacent northwest Iran.
V. xanthina	0	Rock viper	Extreme northeastern Greece, the Greek islands of Simi, Kos, Kalimnos, Leros, Lipsos, Patmos, Samos, Chios and Lesbos, European Turkey, the western half of

Anatolia (inland eastward to Kayseri), and islands (e.g. Chalki, Kastellórizon [Meis Adasi]) of the Turkish mainland shelf.

*) *Not including the nominate subspecies (typical form).*

T) Type species.

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Snake scales

Scales are important for **snakes** - they are deemed to be reptiles by the presence of scales, amongst other things. [1] Snakes are entirely covered with scales or scutes. These scales vary in shape and size. Scales in their myriad variety cover the skin, protect the body of the snake, allow moisture to be retained within and give simple or complex colouration patterns which help in camouflage and antipredator display. Modifications of the scales serve other functions such as 'eyelash' fringes, rattles, and protective covers for the eyes.

Contents

Morphology of scales

Snake scales are formed from the epidermis. Each scale has an outer surface and an inner surface. The skin from the inner surface hinges back and forms a free area which overlaps the base of the next scale which emerges below this scale. [2]

A snake is born with a fixed number of scales. These are not added to or lost as it matures. The scales however grow larger in size and may change shape with each moult.[3]

Snake skin and scales help retain moisture in the animal's body. [4] Snakes can also 'hear' by sensing vibrations with their lower jaw and belly scales.

Surface and shape

Snake scales are of different shapes and sizes. Snake scales may be granular, have a smooth surface or have a longitudinal ridge or keel on it. Often, snake scales have pits, tubercles and other fine structures which may be visible to the naked eye or under a microscope. Snake scales may be modified to form fringes, as in the case of the **Eyelash Bush Viper**, *Atheris ceratophora*, or rattles as in the case of the rattlesnakes of North America.[5]

Certain primitive snakes such as boas, pythons and certain advanced snakes such as vipers have small scales arranged irregularly on the head. Other more advanced snakes have special large symmetrical scales on the head called **shields** or **plates**. [2]

Snakes have smaller scales around the mouth and sides of the body which allow expansion so that a snake can consume prey of much larger width than itself. The ventral scales or belly scales are large and oblong. They protect the soft underside of the snake and also grip surfaces allowing the snake to move. The large scales (called 'shields') on the snake's head play a similar role.[3]

Snake scales are cool and dry and not slimy. [6] That is because scales are made of keratin, the same material that nails and fingernails are made of.[3] Scales, more specifically, consist of mostly hard [2] keratins which are basically transparent. The colours of the scale are due to pigments in the inner layers of the skin and not due to the scale material itself. Scales are hued for all colours in this manner except for blue and green. Blue is caused by the ultrastructure of the scales. By itself, such a scale surface diffracts light and gives a blue hue, while, in combination with yellow from the inner skin it gives a beautiful iridiscent green.

Some snakes have the ability to change the hue of their scales slowly. This is typically seen in cases where the snake becomes lighter or darker with change in season. In some cases, this change may take place between day and night.[3] Snake scales occur in variety of shapes. They may be :-

- cycloid as in Family *Typhlopidae*. [7]
- long and pointed with pointed tips, as in the case of the **Green Vine Snake** *Ahaetulla nasuta*. [8]
- broad and leaf-like, as in the case of green pit vipers *Trimeresurus* spp. [8]
- as broad as they are long, for example, as in **Rat snake** *Ptyas mucosus*. [8]
- keeled weakly or strongly as in the case of the **Buff-striped keelback** *Amphiesma stolatum*. [8]
- with bidentate tips as in some spp of *Natrix*. [8]
- spinelike, juxtaposed as in the **Short Seasnake** *Lapemis curtus*. [2]
- large, non-overlapping knobs as in the case of the **Javan Mudsnake** *Xenodermis javanicus*. [2]
- modified tail scales to form a rattle as in the rattlesnakes of the genera Crotalus and Sistrurus.

Another example of differentiation of snake scales is a transparent scale called the **brille** or **spectacle** which covers the eye of the snake. The snake has no eyelids and the brille protects the eye. It is shed as part of the old skin during moulting.[9]

Moulting

The shedding of scales is called *moulting* or *sloughing*. In the case of snakes, the complete outer layer of skin is shed in one layer. [10] Snake scales are not discrete but extensions of the epidermis hence they are not shed separately, but are ejected as a complete contiguous outer layer of skin during each moult, akin to a sock being turned inside out.[3]

Moulting serves a number of functions - firstly, the old and worn skin is replaced, secondly, it helps get rid of parasites such as mites and ticks. Renewal of the skin by moulting is supposed to allow growth in some animals such as insects, however this view has been disputed in the case of snakes. [11][3]

Moulting is repeated periodically throughout a snake's life. Before a moult, the snake stops eating and often hides or moves to a safe

place. Just prior to shedding, the skin becomes dull and dry looking and the eyes become cloudy or blue-colored. The inner surface of the old outer skin liquefies. This causes the old outer skin to separate from the new inner skin. After a few days, the eyes clear and the snake "crawls" out of its old skin. The old skin breaks near the mouth and the snake wriggles out aided by rubbing against rough surfaces. In many cases the cast skin peels backward over the body from head to tail, in one piece like an old sock. A new, larger, and brighter layer of skin has formed underneath. [3][12]

An older snake may shed its skin only once or twice a year, but a younger, still-growing snake, may shed up to four times a year.[12] The discarded skin gives a perfect imprint of the scale pattern and it is usually possible to identify the snake if this discard is reasonably complete and intact.[3]

Taxonomic importance

Scales do not play an important role in distinguishing between the families but are important at generic and specific level. There is an elaborate scheme of nomenclature of scales. Scales patterns, by way of scale surface or texture, pattern and colouration and the division of the anal plate, in combination with other morphological characteristics, are the principal means of classifying snakes down to species level. [13]

In certain areas in North America, where the diversity of snakes is not too large, easy keys based on simple identification of scales have been devised for the lay public to distinguish poisonous snakes from non-poisonous snakes.[14][15] In other places with large biodiversity, such as Myanmar, publications caution that venomous and non-venomous snakes cannot be easily distinguished apart without careful examination.[16]

Identification of snakes by reference to scales seems an arcane art to the amateur naturalist because the nomenclature of snake scales seems esoteric and, more importantly, the snakes need to be caught and the head and body examined closely in hand for identification. The advent of high definition digital cameras means that images taken of snakes, if of appropriate definition and of the correct position, would show scales that can be examined, distinguished and counted without the need for catching and handling.

The scales patterning may also be used for individual identification in field studies. Clipping of specific scales to mark individual snakes is a popular approach to population estimation by mark and recapture techniques.

Nomenclature of scales

This part of the article provides a photographic guide cum glossary of scale names on a snake's head and body for easy and convenient identification by the reader, with annotated photographs of **Buff-striped Keelback** *Amphiesma stolata* (a common grass-snake of South Asia) for following the text.

Head scales

Identification of scales is most conveniently begun with reference to the nostril which is easily identified on the snake. There are two scales enclosing the nostril which are called the **nasals**. The outer nasal (near the snout) is called the **prenasal**. The inner nasal (near the eye) is called the **postnasal**. Along the top of the snout connecting the nasals on both sides of the head are scales called **internasals**.

Between the two prenasals is a scale at the tip of the snout. This is called the **rostral** scale.

The scales around the eye are called **circumorbital** scales and are named as ocular scales but with appropriate prefix. The **ocular scale** proper is a transparent scale covering the eye. The ocular scale is also called **spectacle**, **brille** or **eyecap**.

The circumorbital scales towards the snout or the front are called **preocular** scales, those towards the rear are called **postocular** scales and those towards the upper or dorsal side are called as **supraocular** scales. Circumorbital scales toawrds the venral or lower side, if any, are called as **subocular** scales.

Between the preocular and the postnasal scales are the **loreal** scales.

The scales along the lips of the snake are called as **labials**. Those on the upper lip are called **supralabials** while those on the lower labial are called **infralabials**.

Between the eyeballs on top of the head, adjacent to the supraoculars are the **frontal** scales. The **prefrontal** scales are the scales connected to the frontals towards the tip of the snout which are in contact with the internasals.

The back of the top of the head has scales connected to the frontal scales called as the **parietal** scales. At the sides of the back of the head are scales called **temporal** scales.

On the underside of the head, a snake has an anterior scale called as the **mental** scale. Connected to the mental scales and all along the lower jaws are the **infralabials**. Along the lower jaw connected to

infralabials are a pair of shields called the **anterior chin shields**. Next to the anterior chin shields, further back along the jaw are another pair of shields called the **posterior chin shields**.

Scales on the body

The scales on the body of the snake are called the **dorsal** or **costal** scales. Sometimes there is a special row of large scales along the top of the back of the snake, i.e, the uppermost row, called the **vertebral** scales.

The enlarged scales on the belly of the snake are called **ventral** scales or **gastrosteges**.

In "advanced" (Caenophidian) snakes, the broad belly scales and rows of dorsal scales correspond to the vertebrae, allowing scientists to count the vertebrae without dissection.

Tail scales

At the end of the ventral scales of the snake is an anal plate which protects the opening to the cloaca (a shared opening for waste and reproductive material to pass) on the underside near the tail. This **anal** scale may be single or divided into a pair. The part of the body beyond the anal scale is considered to be the tail.[17]

Sometimes snakes have enlarged scales, either single or paired, under the tail; these are called **subcaudals** or **urosteges**. These subcaudals may be smooth or keeled as in Bitis arietans somalica. The end of the tail may simply taper into a tip (as in the case of most snakes), it may form a spine (as in Acanthophis), end in a bony spur (as in Lachesis), a rattle (as in Crotalus), or a rudder as seen in many sea snakes.

The rattlesnake tail is made up of a series of loosely linked, interlocking chambers that when shaken, vibrate against one another to create the warning signal of a rattlesnake. Only the bottom button is firmly attached to the tip of the tail.[17]

Sources. Details for this section have been sourced from scale diagrams in **Malcolm Smith**.[18] Details of scales of Buff-striped Keelback have been taken from **Daniels**. [19]

Arrangement of scales

Snake have imbricate scales, overlapping like the tiles on a roof. [20] Snakes have rows of scales along the whole or part of their length and also many other specialised scales, either singly or in pairs, occurring on the head and other regions of the body.

The dorsal scales on the snake's body are arranged in rows along the length of their bodies. Adjacent rows are diagonally offset from each other. Most snakes have an odd number of rows across the body though certain species have an even number of rows e.g. *Zaocis* spp. [2] In the case of some aquatic and marine snakes, the scales are granular and the rows cannot be counted . [20]

The number of rows range from ten in **Tiger Ratsnake** *Spilotes pullatus*; thirteen in *Dryocalamus*, *Liopeltis*, *Calamaria* and Asian coral snakes of genus *Calliophis*; 65 to 75 in *Python*; 74 to 93 in *Kolpophis* and 130 to 150 in *Acrochordus*. The majority of the largest family of snakes, the **Colubridae** have 15, 17 or 19 rows of scales. [2][21]

The maximum number of rows are in mid-body and they reduce in count towards the head and on the tail.

Glossary of scales

- **Scales on the head**.
  - Rostral.
    Nasorostral.
  - Nasal.
    - Prenasal.
      Postnasal.
      Supranasal.
      Fronto-nasal.
  - Internasal.
    Brille, spectacle, ocular scale,[3] eyecap.[22].
  - Circumorbital.
    - Preocular.
      Postocular.
      Supraocular.
      Subocular.
  - Loreal.
    Interorbital, Intersupraocular.
    Frontal.
    Prefrontal.
    Parietal.
    Occipital.
    Interoccipital.
    Temporal.
  - Labial.
    - Supralabial, Upper labial.
      Sublabial, Infralabial, Lower labial.
  - Mental.
  - Chin shield.
    - Anterior chin shield.
      Posterior chin shield.
      Intergeneial.
  - Gular.
- **Scales on the body**.
  - Dorsal.
    Vertabral.
    Ventral, Gastrostege.
- **Scales on the tail**.
  - Anal.
    Subcaudal, Urostege.

Use of scales in distinguishing between venomous and non-venous snakes

Finding out whether a snake is venomous or not is correctly done by identification of the species of a snake with the help of experts, or in their absence, close examination of the snake and using authoritative references on the snakes of your geographical region to identify it. Scale patterns help indicate the species and from the references, it can be verified if the snake species is venomous or not.

A point to note is that identification requires a fair degree of knowledge about snakes, their taxonmy, snake-scale nomenclature as well as familiarity and access to authoritative scientific texts on snakes. Handling of live snakes by persons other than trained handlers for identification or any other reason is not advised.

In South Asia, it is adviseable to kill the snake which has bitten a person and carry it along to the hospital for possible identification by medical staff so that informed decision can be taken them as to whether anti-venin is to be administered or not.

In certain regions, experts use presence or absence of certain scales to distinguish between non-venomous and venomous scales, with well-understood exceptions. For example, in relation to venomous snakes of Myanmar, the distribution of snakes permits the use of the presence or absence of loreal scales to distinguish between relatively harmless Colubrids and lethally venomous Elapids[16].

The rule of hand for this region is that the absence of a loreal scale between the nasal scale and pre-ocular scale indicates that the snake is an Elapid and hence lethal[16].

Please note that this rule-of-hand applies to terrestrial venomous snakes only and that vipers are an exception since they cannot be so classified due to the large number of small scales on the head. Subsequently a further check is to be carried out in the case of identified Colubrids to exclude known poisonous members of their family such as *Rhabdopis* species[16].

Cultural significance

The highly periodic cross-hatch or grid patterns on snakeskin appeal to people's aesthetics. Snakeskin is used to manufacture of many leather articles including fashionable accessories.[23] The use of snakeskin has endangered snake populations[24] and resulted in international restrictions in trade of certain snake species and populations in the form of CITES provisions.[25] Animal lovers in many countries propagate the use of artificial snakeskin instead, which are easily produced from embossed leather, patterned fabric, plastics and other materials.[23]

Snake scales have inspired dread and awe in humans from pre-historic times. Patterns in art prevalent to those times and later on may be ascribed to the visual influence of snakes, some of which, such as the Gaboon Viper, can both repel and fascinate the human mind. Studies of fear imagery and psychological arousal indicate that snake scales are a vital component of snake imagery. Snake scales also appear to have affected Islamic art in the form of tessallated mosaic patterns which show great similarity to snake-scale patterns.[23]

A snake scale was portrayed as a clue in the 1982 sci-fi cum film noir called 'Blade Runner'. [26]

Snake scales occur as a motif regularly in computer action games. [27][28][29][30]

Snake scales also figure in popular fiction, such as the Harry Potter series (as a raw material for concocting potions), and also in teen fiction [31].

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See also

- Reptile
- Snake

Snakes in mythology

Snakes were central to many myth-systems because of their perceived quality of being both familiar and exotic. The behaviour of snakes and their facial features (e.g. the unblinking, lidless eyes) seemed to imply that they were intelligent, that they lived by reason and not instinct, and yet their thought-processes were as alien to humans as their ways of movement.

In some cultures snakes were fertility symbols, for example the Hopi people of North America performed an annual snake dance to celebrate the union of Snake Youth (a Sky spirit) and Snake Girl (an Underworld spirit) and to renew fertility of Nature. During the During the dance, live snakes were handled and at the end of the dance the snakes were released into the fields to guarantee good crops. In other cultures snakes symbolised the umbilical cord, joining all humans to Mother Earth. The Great Goddess often had snakes as her familiars - sometimes twining around her sacred staff, as in ancient Crete - and they were worshipped as guardians of her mysteries of birth and regeneration.

Contents

Snakes and immortality

Some cultures regarded snakes as immortal because they appeared to be reincarnated from themselves when they sloughed their skins. Snakes were often also associated with immortality because they were observed biting their tails to form a circle and when they coiled they formed spirals. Both circles and spirals were seen as symbols of eternity. The circle was particularly important to Dahomeyan myth where the snake-god Danh circled the world like a belt, corsetting it and preventing it from flying apart in splinters. In ancient Egypt, the snake biting its tail symbolised the sea as the eternal ring which enclosed the world.

Snakes and creation

Snakes were a common feature of many creation myths, for example many peoples in Africa and Australia had myths about a Rainbow Snake, which was either Mother Earth herself giving birth to all animals or a water-god whose writhings created rivers, creeks and oceans. In ancient Indian myth, the drought-serpent Ahi or Vritra swallowed the primordial ocean and did not release all created beings until Indra split the serpents stomach with a thunderbolt. In another myth, the creator Brahma slept on the coils of the world-serpent Shesha (or Ananta the endless; a part of Vishnu, the child of the primordial waters). Shesha in turn was supported on Kurma (another part of Vishnu) and when Kurma moved, Shesha stirred and yawned and the gaping of its jaws caused earthquakes.

Greek cosmological myths tell of how Ophion the snake incubated the primordial egg from which all created things were born. In Egyptian myth, the state of existence before creation was symbolised as Amduat, a many-coiled serpent from which Ra the Sun and all of creation arose, returning each night and being reborn every morning.

Snakes and the underworld

Snakes were regularly regarded as guardians of the Underworld or messengers between the Upper and Lower worlds because they lived in cracks and holes in the ground. The Gorgons of Greek myth were snake-women (a common hybrid) whose gaze would turn flesh into stone. In Indian myth nagas and naginis were human-headed snakes whose kings and queens lived in jewel-encrusted underground or underwater paradises and who were perpetually at war with Garuda the Sun-bird. In Nordic myth, evil was symbolised by the serpent Nidhogg (the 'Dread Biter') who coiled around one of the three roots of Yggdrasil the Tree of Life, and tried to choke or gnaw the life from it. Similarly, in Egyptian myth every morning the serpent Aapep (symbolising chaos) attacked the Sunship (symbolising order). Aapep would try to engulf the ship and the sky was drenched red at dawn and dusk with its blood as the Sun defeated it.

The idea of snake-people living below the Earth was prominent in American myth. The Aztec underworld, Mictlan, was protected by python-trees, a gigantic alligator and a snake, all of which spirits had to evade by physical ducking and weaving or cunning, before they could start the journey towards immortality. In North America, the Brule Sioux people told of three brothers transformed into rattlesnakes which permanently helped and guided their human relatives. The Pomo people told of a woman who married a rattlesnake-prince and gave birth to four snake-children who freely moved between the two worlds of their parents. The Hopi people told of a young man who ventured into the underworld and married a snake-princess. Amongst the Navajo people is a tale of Glispa, a girl returned with magical healing lore after spending two years with the Snake People by the Lake of Emergence in the underworld. Healing and snakes were also associated in ancient Greek myth with Aesculapius, whose snake-familiars would crawl across the bodies of sick people asleep at night in his shrines and lick them back to health.

Snakes and water

Snakes were also commonly associated with water especially myths about the primordial ocean being formed of a huge coiled snake as in Ahi/Vritra in early Indian myth and Jormungand in Nordic myth. Sea monsters lived in every ocean from the seven-headed crocodile-serpent Leviathan of Hebrew myth to the sea-god Koloowisi of the Zuni people of North America and the Greek monster Scylla with twelve snake-necks. In some cultures, eels (which spend their early lives in freshwater before returning to the sea as adults) were regarded as magical creatures.

Rivers and lakes often had snake-gods or snake-guardians including Untekhi the fearsome water-spirit of the Missouri River. Until recently, some northern European communities held well-dressing ceremonies to appease the snake-spirits which lived in village wells and told legends of saints defeating malevolent lake-snakes e.g. Saint George killing a maiden-devouring serpent or Saint Columba lecturing the Loch Ness Monster which then stopped eating humans and became shy of human visitors.

Snake-gods

The anthropopmorphic basis of many myth-systems mean't snake-gods were rarely depicted solely as snakes. Exceptions to this were the Fijian creator-god Ndengei, the dozen creator-gods of the Solomon Islands (each with different responsibilities), the Aztec Mother Goddess Coatlicue, and the Voodoo snake-spirits Damballah, Simbi and Petro. Snake-gods were more often portrayed as hybrids or shape-shifters, for example North American snake-spirits could change between human and serpentine forms whilst keeping the characteristics of both.

The most important American snake-god was the Aztec spirit of intelligence and the wind, Quetzalcoatl (**Plumed Serpent**), who was balanced by the evil spirit of sacrifice, the Serpent of Obsidian Knives which was one of the four pillars supporting the sky. In each case the association with snakes was based on imagery rather than snake-like qualities. The Mayan sky-goddess I had snake-hair, which was a common attribute. However, in her case the snakes leaned into her ears and whispered the secrets of the universe i.e. the secrets of herself. In Indian myth, Shiva had a cobra coiled on his head and another at rest on his shoulder, ready to strike his enemies. Egyptian myth had had several snake-gods from the 'coiled one' Mehen who assisted Ra in fighting Aapep every day to the two-headed Nehebkau who guarded the underworld.

Snakes and wisdom

Snakes were associated with wisdom in many mythologies, perhaps due to the appearance of pondering their actions as they prepare to strike, which was copied by medicine men ibn the build-up to prophecy in parts of West Afirca. Usually the wisdom of snakes was regarded as ancient and beneficial towards humans but sometimes it could be directed against humans. In East Asia snake-dragons watched over good harvests, rain, fertility and the cycle of the seasons, whilst in ancient Greece and India, snakes were considered to be lucky and snake-amulets were used as talismans against evil.

In northern Europe and West Asia, snakes were associated with healing whilst in parts of South Asia, snakes are regarded as possessing aphrodisiac qualities. Greek myth held that people could acquire second hearing and second sight if their ears or eyes were licked by a snake. Tiresias gained a dual male-female nature and an insight into the supernatural world when he killed two snakes which were coupling in the woods.

Hebrew myth relates that in the Garden of Eden, the Tree of Knowledge had a snake-guardian; a story which was extended into the corruption of Eve in Judaic and Christian teachings and has led to the common perception in the West that humans and snakes were eternal opponents - a view shared by few myth-systems across the world.

In the state of Kerala, India, snake shrines occupy most households. Snakes were called upon by the creator of Kerala, Parasurama, to make the saline land fertile. The Mannarasala Shri Nagaraja Temple is one of the main centres of worship. The presiding deity here is Nagaraja - a five hooded snake god born to human parents as a blessing for their caretaking of snakes during a fire. It is believed that Nagaraja left his earthly life and took samadhi but still resides in a chamber of the temple.

Pythonomorpha

Conservation status: Fossil

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Squamata
(unranked) **Pythonomorpha**

Pythonomorpha was originally proposed by paleontologist Edward Drinker Cope (1869) as a reptilian order comprised of snakes and mosasaurs. Cope wrote, "In the mosasauroids, we almost realize the fictions of snake-like dragons and sea-serpents, in which men have been ever prone to indulge. On account of the ophidian part of their affinities, I have called this order Pythonomorpha." However, the category was rejected by most 20th-Century herpetologists and paleontologists , who sought, instead, to demonstrate a close relationship between mosasaurs and varanid (monitor) lizards and who generally considered snakes to have evolved from terrestrial, burrowing lizards (see, for example, Russell, 1967). Recently, though, Cope's Pythonmorpha has been revised and resurrected by a number of paleontologists (Lee, 1997; Caldwell et Lee, 1997) who have conducted extensive cladistic anaylses which seem to show that snakes and mosasaurs may be more closely related to one another than either is to the varanid lizards and that snakes more likely arose from aquatic ancestors. As redefined by Lee (1997), the monophyletic Pythonomorpha consists of "The most recent common ancestor of mosasauroids and snakes, and all its descendants." This includes the aigialosaurs, dolichosaurs, coniasaurs, mosasaurs, and all snakes. Lee (1997) was able to show no less than 38 synapomorphies supporting Pythonomorpha.

The etymology of the term Pythonomorpha comes from the Greek Python (a monsterous snake from Greek mythology) and morphe ("form"), and refers to the generally serpentine body plan of members of the clade.

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Toxicofera

Toxicofera (Latin for "those who bear toxins"), is a clade which represents about 4600 species (nearly 60%) of Squamates; it encompasses all venomous reptile species, as well as numerous related non-venomous species.

Contents

Details

Toxicofera combines the following groups from traditional classification:

- suborder Serpentes (snakes)
- suborder Iguania (anoles, chameleons, iguanas, etc.)
- infraorder Anguimorpha, consisting of:
  - family Varanidae (monitor lizards, including the Komodo dragon)
  - family Anguidae (alligator lizards, glass lizards, etc.)
  - family Helodermatidae (Gila monster and Mexican beaded lizard)

Background

In 2003 groundbreaking work by Dr. Bryan Grieg Fry was published that showed nearly all "non-poisonous" snakes produce venom to a certain extent. This suggested a far more ancient origin for venom in Serpentes than had been considered until then, laying the foundation for future research.

Before the publication of the Toxicofera hypothesis, venom in Squamates was only known in Serpentes and Helodermatidae. Part of the original research that led to the venom clade was the discovery of venom (or venom genes) in species from groups (Iguania and Varanidae) which were not previously known to produce it (Anguidae was included in the venom clade for phylogenetic reasons).

Toxicofera was described simply as the "venom clade" when first proposed to the scientific community by Fry, et al, in the Journal Nature in 2005. It was given a formal name by his associates, Vidal and Hedges, in the Journal Comptes Rendus Biologies (CR Biologies) the same year.

Conclusions

It was estimated that the common ancestral species that first developed venom in the venom clade lived on the order of 200 million years ago, approximately 100 million years before snakes evolved.

The venoms are thought to have resulted after genes normally active in various parts of the body duplicated and the copies found new use in the salivary glands.

The newly discovered diversity of Squamate species producing venoms is a treasure trove for those seeking to develop new pharmaceutical drugs; many of these venoms lower blood pressure, for example.

Lepidosauromorpha

Lepidosauromorphs
Fossil range: Late Permian - Recent
Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Subclass: Diapsida
Infraclass: **Lepidosauromorpha**
Orders: See text

Lepidosauromorpha is a group of reptiles comprising all diapsids closer to lizards than to archosaurs (including crocodiles and birds). The only living sub-group is the Lepidosauria: extant lizards, snakes, and tuatara.

Classification

- **Subclass Diapsida**
  - **LEPIDOSAUROMORPHA**
    - *Acerosodontosaurus* (extinct)
    - **Superorder Sauropterygia** - Plesiosaurs (extinct)
    - **Lepidosauriformes**
      - **Order Eolacertilia** (extinct)
        - *Icarosaurus*
        - *Kuehneosaurus*
      - **Superorder Lepidosauria**
        - **Order Sphenodontia** - Tuatara
        - **Order Squamata**
          - **Suborder Lacertilia** - Lizards
            - Family Mosasauridae
          - **Suborder Serpentes** - Snakes
          - **Suborder Amphisbaenia** - Worm lizards

A new phylogenetic analysis indicates that indeed there are two major branches to the reptile family tree, the archosauromorphs and the lepidosauromorphs. Cephalerpeton is at the base of the Lepidosauromorpha. More derived clades include capitorhinids; an unnamed clade that includes caseids, Milleretta, Oedaleops, Eunotosaurus and Acleistorhinus; Belebey plus Bolosaurus; diadectomorphs; Procolophon; pareiasaurs including turtles; Lanthanosuchus; Nyctiphruretus; owenettids; Paliguana; Saurosternon; Coelurosauravus; kuehneosaurids; Homoeosaurus and the sphenodontids (including rhynchosaurs and trilophsaurs); and finally three clades of lepidosaurs. The three clades include two traditional ones with extant members, the Iguania and the Scleroglossa. The third and newest lepidosaur clade has Huehuecuetzpalli at its base followed by Jesairosaurus + the drepanosaurids and Macrocnemus + the Fenestrasauria, which includes tanystropheids and pterosaurs among others. Acerosodontosaurus and sauropterygians are archosauromorphs in the new analysis.

Marine reptiles

List of marine reptiles | Mosasaurs | Sauropterygia | Sea turtles

List of marine reptiles

Euryapsids

- Plesiosaurs
- Ichthyosaurs
- placodonts

Diapsids

- mosasaurs
- saltwater crocodiles
- marine Iguanas

Sea turtles

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Testudines
Suborder: Cryptodira
Superfamily: **Chelonioidea,** Bauer, 1893
Genera
Family Cheloniidae (Oppel, 1811)
Caretta
Lepidochelys
Chelonia
Eretmochelys
Natator
Family Dermochelyidae
Family Protostegidae (extinct)
Family Toxochelyidae (extinct)
Family Thalassemyidae (extinct)

Sea turtles (*Chelonioidea*) are turtles found in all the world's oceans with the exception of the Arctic Ocean, and some species travel between oceans. The Flatback turtle is found solely on the northern coast of Australia. The Leatherback Sea Turtle is the largest, measuring six or seven feet (2 m) in length at maturity, and three to five feet (1 to 1.5 m) in width, weighing up to 1300 pounds (600 kg). Most other species are smaller, being two to four feet in length (0.5 to 1 m) and proportionally less wide. There are seven types of sea turtles: Kemp's Ridley, Flatback, Green, Olive Ridley, Leatherback, Loggerhead, and Hawksbill.

Different species are distinguished by varying anatomical aspects: for instance the prefrontal scales on the head, the number of and shape of scutes on the carapace, and the type of inframarginal scutes on the plastron. The Leatherback is the only sea turtle that does not have a hard shell, instead carrying a mosaic of bony plates beneath its leathery skin.

Sea turtles have an extraordinary sense of time and location. They are highly sensitive to the Earth's magnetic field and probably use it to navigate. They can live up to 189 years. The fact that most species return to nest at the locations where they were born seems to indicate an imprint of that location's magnetic features. The ridley turtles are especially peculiar because instead of nesting individually like the other species, they come ashore in one mass arrival known as an "arribada" (arrival). With the Kemp's ridley this occurs during the day

and on only one beach in the entire world. Their numbers used to range in the thousands but due to the effects of extensive egg poaching and hunting in previous years the numbers are now in the hundreds.

After about 30 years of maturing, adult female sea turtles return to the land to nest, usually on the same beach from which they hatched. This can take place every two to four years in maturity. They make from four to seven nests per nesting season. They dig a hole with their hind flippers and lay from 70 to 190 eggs in it (depending on the species) before covering it up and returning to the ocean. Some of the eggs are unfertilized 'dummy eggs' and the rest contain young turtles. Incubation takes about 2 months. When the eggs hatch, these baby turtles dig their way out and seek the ocean. Only a very small proportion of them (usually 1%) will be successful, as many predators wait to eat the steady stream of new hatched turtles (since many sea turtles lay eggs en masse, the eggs also hatch en masse).

Contents

Threats to Sea Turtles

All species of sea turtles are endangered. The Leatherback, Kemp's ridley, and Hawksbill turtles are listed as critically endangered. The Olive ridley, Loggerhead, and Green turtles are considered endangered. The Flat back is considered data deficient due to lack of research. Sea turtles used to be hunted on a large scale in the whaling days for their meat, fat and shells, and coastal peoples have always gathered turtle eggs for consumption. Their biggest threat now comes from long-line fishing, and as bycatch in shrimp nets, as well as over development on inexpensive changes to fishing techniques, such as slightly larger hooks and traps from which sea turtles can escape, can dramatically cut the mortality rate. Another danger comes from marine debris, especially from abandonded fishing nets in which they can become entangled.

Beachs development is another area which poses threats to sea turtles. Since sea turtles return to the same beach locations to nest, if these areas are developed they may be left with nowhere to nest, or their nesting locations may be threatened by human activity. Therefore, there has been a movement to protect these areas, in some cases by special police. In some areas, such as the east coast of Florida, after the adult turtles lay their eggs, they are dug up and relocated to special fenced nurseries where they can be protected from beach traffic. This is not the best thing to do, as many turtle species return to the beach on which they were born. Special lighting ordinances may also be enforced to prevent lights from shining on the beach and confusing young hatchlings from thinking it is the moon or sun and crawling toward it, usually crossing a road.

One of the biggest threats to sea turtles is the black market trade in eggs and meat. This is a pervasive problem throughout the world, but especially a concern in India, Indonesia and throughout the coastal nations of Latin America. Estimates are as high as 35,000 turtles killed a year in Mexico and the same number in Nicaragua. Conservationists in Mexico and the United States have launched "Don't Eat Sea Turtle" campaigns in order to reduce the urban black market trade in sea turtle products. These campaigns have involved figures such as Pope John Paul II, Dorismar, Los Tigres del Norte and Mana.

Injured sea turtles are sometimes able to be rescued and rehabilitated by professional organizations such as the Marine Mammal Center in Northern California.

Sea turtles and fragile ecosystems

Sea turtles play key roles in two ecosystems that are critical to them as well as to humans—the oceans and beaches/dunes. If sea turtles were to become extinct, the negative impact on beaches and the oceans would be enormous.

In the oceans, for example, sea turtles, especially green sea turtles, are one of the very few creatures (manatees are another) that eat a type of vegetation called sea grass that grows on the sea floor. Sea grass must be kept short to remain healthy, and beds of healthy sea grass are essential breeding and development areas for many species of fish and other marine life. A decline or loss of sea grass beds would mean a loss of the marine species that directly depend on the beds, which would trigger a chain reaction and negatively impact marine and human life. When one part of an ecosystem is destroyed, the other parts will follow.

Beaches and dunes are a fragile ecosystem that does not get many nutrients to support its vegetation, which is needed to help prevent erosion. Sea turtles contribute nutrients to dune vegetation from their eggs. Every year, sea turtles lay countless numbers of eggs in beaches during nesting season. Along one twenty-mile stretch of beach in Florida alone, for example, more than 150,000 pounds of eggs are laid each year. Nutrients from hatched eggs as well as from eggs that never hatch and from hatchlings that fail to make it into the ocean are all sources of nutrients for dune vegetation. A decline in the number of sea turtles means fewer eggs laid, less nutrients for the sand dunes and its vegetation, and a higher risk for beach erosion.

The plight of sea turtles has been recognized around the world, and many organizations and governments are working to preserve these ancient creatures. Volunteer opportunities to save sea turtles and sea turtle habitats are available in North America and around the world.

Taxonomy

All sea turtles belong to the *Superfamily Chelonioidea*. Today, there are only six genera of sea turtles in two families, but in the past there have been as many as five sea turtle families containing dozens puss of genera. The classification presented here follows Hirayama (1997, 1997), Lapparent de Broin (2000), and Parham (2005) [1].

- **Superfamily CHELONIOIDEA**
    - **Family Toxochelyidae**
        - Toxochelys
          Porthochelys
          Thinochelys
    - **Family Cheloniidae**
        - Ctenochelys
          Prionochelys
          Peritresius
          Euclastes
          Allopleuron
          Procolpochelys
          Puppigerus
          Argillochelys
          Caretta (Loggerhead turtle)
          Syllomus
          Natator (Flatback turtle)
        - **Subfamily Cheloninae**
            - Eretmochelys (Hawksbill turtle)
              Lepidochelys (Ridley's turtle)
              Chelonia (Green sea turtle)
    - **Family Thalassemyidae**
        - Desmemys
          Padiochelys
          Thalassemys
          Tropidemys
          Yaxartermys
    - **Family Dermochelyidae**
        - Corsochelys
          Cardiochelys
          Protosphargis
          Eosphargis
          Psephophorus
          Mesodermochelys
          Dermochelys (Leatherback sea turtle)
    - **Family Protostegidae**

- Santanachelys
  Notochelone
  Desmatochelys
  Rhinochelys
  Chelosphargis
- **Subfamily Protosteginae**
  - Calcarichelys
    Microstega
    Atlantochelys
    Protostega
    Archelon

Further reading

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Parareptiles

Fossil range: Permian to Triassic (without Chelonia); or Permian to Recent (if incl. Chelonia)

Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Superclass: Tetrapoda
Class: Reptilia/Sauropsida
Subclass: **Parareptilia,** Olson, 1947
Groups: See cladograms below

Parareptilia ("at the side of reptiles") is a subclass or clade of Reptiles which are variously defined as an extinct group of primitive anapsids, or a more cladistically correct alternative to Anapsida. Whether the term is valid depends a lot on the phylogenetic position of turtles, the relationships of which to other reptilian groups are still uncertain

The name Parareptilia was coined by Olson 1947 to refer to an extinct group of Paleozoic reptiles, as opposed to the rest of the reptiles or Eureptilia ("true reptiles").

The name fell into disuse, until it was revived by cladistic studies, to refer to anapsida that were thought unrelated to turtles. Gauthier et al. 1988 provided the first phylogenetic definitions for the names of many amniote taxa, including Sauropsida as the parent clade for Reptilia, and argued cladistically that captorhinids and turtles were sister groups, constituting the clade Anapsida (in a much more limited context than the definition given by Romer 1967). A name had to be found for various Permian and Triassic reptiles no longer included in the Anapsids, and "Parareptiles" was chosen. However, they did not feel confident enough to erect Parareptilia as a formal taxon. Their cladogram was as follows:

```
--o AMNIOTA |-- Synapsida `--o Sauropsida |--o "parareptiles" | |-- Mesosauridae | `--+-- Procolophonidae | `--+-- Millerettidae | `-- Pareiasauria `--o Reptilia |---o Anapsida | |-- Captorhinidae | `-- Testudines `--o Romeriida |-- Protorothyrididae `-- Diapsida
```

Laurin and Reisz 1995 presented a different cladogram, in which the Reptilia are divided into Parareptilia (now a formal taxon) and Eureptilia. The Captorhinidae are transferred to the Eureptilia, and the Parareptilia includes both early Anapsid reptiles and turtles, but not the Captorhinidae and Protorothyrididae. The mesosaurs are placed outside both groups, as the sister taxon to the reptiles (but still

sauropsids). The traditional taxon of Anapsida is rejected as paraphyletic. This gives the following:

```
--o AMNIOTA |-- Synapsida `--o Sauropsida |--
Mesosauridae `--o Reptilia |--o Parareptilia | |--
Millerettidae | `--+-- Pareiasauria | `--+--
Procolophonidae | `-- Testudines `--o Eureptilia |--
Captorhinidae `--o Romeriida |-- Protorothyrididae
`-- Diapsida
```

In contrast, Rieppel, 1994, 1995; Rieppel & deBraga, 1996; and deBraga & Rieppel, 1997 have argued that turtles are actually related tro sauropterygia, and hence are diapsids. The diapsid affinities of turtles have also been supported by molecular phylogeny (e.g. Zardoya and Meyer 1998). If so, this would mean that the Parareptilia would become a wholy extinct clade. However this hypothesis is not very widely accepted among vertebrate paleontologists, and Benton 2000, 2004, retains the traditional class Anapsida for the "parareptiles" and turtles.

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Pareiasaurus

Pareiasaurus

Conservation status: Fossil

Fossil range: Mid Permian

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Procolophonomorpha
Suborder: Procolophonia
Family: Pareiasauridae
Genus: ***Pareiasaurus***

Species

- *P. baini*
- *P. bombidens*
- *P. russouwi*
- *P. serridens*

Pareiasaurus is an extinct genus of anapsid reptile from the Permian period. It was about 2,50 m (8 ft 4 in) long.

Pareiasaurus was a large quadruped with elephantine legs, walking in a semi-erect posture. Its skull had several spine- and wart-like protrusions. Pareiasaurus's leaf-shaped teeth, ideal for biting through tough plant fibers, indicate it was a herbivore. Even the pallet had teeth on it.

Pet reptiles

African helmeted turtle | Boa genus | Central Bearded Dragon | Corn Snake | Iguana | Leopard gecko | Lesser Antillean Iguana | Lizard | Marginated Tortoise | Snake | Turtle

Turtle

Fossil range: Triassic - Recent
Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: **Testudines,** Linnaeus, 1758
Suborders
Cryptodira
Pleurodira
See text for families.

Turtles are reptiles of the order **Testudines** (all living turtles belong to the crown group **Chelonia**), most of whose body is shielded by a special bony or cartilagenous shell developed from their ribs. The Order Testudines includes both extant (living) and extinct species, the earliest turtles being known from the early Triassic Period, making turtles one of the oldest reptile groups, and a much more ancient group than the lizards and snakes. About 300 species are alive today. Some species of turtles are highly endangered. Like birds, turtles are able to detect the Earth's magnetic field with magnetosensors, which allow them to migrate.

Contents

Evolution

The first turtles are believed to have existed in the Mesozoic, around 200 million years ago. Their exact ancestry is disputed. It was believed that they are the only surviving branch of the ancient clade Anapsida, which includes groups such as procolophonoids, millerettids, protorothyrids and pareiasaurs. All anapsid skulls lack a temporal opening, while all other extant amniotes have temporal openings (although in mammals the hole has become the zygomatic arch). Most anapsids became extinct in the late Permian period, except procolophonoids and possibly the precursors of the testudines (turtles).

However, it was recently suggested that the anapsid-like turtle skull may be due to reversion rather than to anapsid descent. More recent phylogenetic studies with this in mind placed turtles firmly within diapsids, slightly closer to Squamata than to Archosauria. All molecular studies have strongly upheld this new phylogeny, though some place turtles closer to Archosauria. Re-analysis of prior phylogenies suggests that they classified turtles as anapsids both because they assumed this classification (most of them studying what sort of anapsid turtles are) and because they did not sample fossil and extant taxa broadly enough for constructing the cladogram. Future analyses may show the turtles to be relatives of the placodonts.

A new phylogenetic analysis agrees with prior analyses nesting turtles with pareiasaurs within the much larger clade, Lepidosauromorpha. The closest pareiasaur to turtles appears to be a rarely-studied form, Stephanospondylus. Indeed turtles are related to other reptiles without temporal openings. They are also closer to lizards than they are to archosaurormophs, including placodonts.

The earliest known modern turtle is proganochelys, though this species already had many advanced turtle traits, and thus probably had many millions of years of preceding "turtle" evolution and species in its ancestry. It did lack the ability to pull its head into its shell (and it had a long neck), and had a long, spiked tail ending in a club, implying an ancestry occupying a similar niche to the ankylosaurs (though, presumably, only parallel evolution).

Physical description

Turtles vary widely in size, although marine turtles tend to be relatively big animals. The largest chelonian is a marine turtle, the great leatherback sea turtle, which can reach a shell length of 200 cm (80 inches) and can reach a weight of over 900 kg (2,000 lb, or 1 short ton). Freshwater turtles are smaller, with the largest species being the Asian softshell turtle *Pelochelys cantorii*, which has been reported to measure up to 200 cm or 80 in (Das, 1991). This dwarfs even the better-known alligator snapping turtle, the largest chelonian in North America, which attains a shell length of up to 80 cm (31½ in) and a weight of about 76 kg (170 lb). Giant tortoises of the genera *Geochelone*, *Meiolania*, and others were relatively widely distributed around the world into prehistoric times, and are known to have existed in North and South America, Australia, and Africa. They became extinct at the same time as the appearance of Man, and it is assumed that humans hunted them for food. The only surviving giant tortoises are on the Seychelles and Galápagos Islands and can grow to over 130 cm (50 in) in length, and weigh about 300 kg (670 lb) [1].

The largest ever chelonian was Archelon ischyros, a Late Cretaceous sea turtle known to have been up to 4.6 m (15 ft) long [2].

The smallest turtle is the speckled padloper tortoise of South Africa. It measures no more than 8 cm (3 in) in length and weighs about 140 g (5 oz). Two other species of small turtles are the American mud turtles and musk turtles that live in an area that ranges from Canada to South America. The shell length of many species in this group is less than 13 cm (5 in) in length.

Some sea turtles have evolved gills near the anus to assist with respiration. These are distinct from the pharyngeal gills (which fish have, and which are lost during embryonic development in turtles).

Neck folding

Turtles are broken down into two groups, according to how they evolved a solution to the problem of withdrawing their neck into their shell (something the ancestral Proganochelys could not do): the Cryptodira, which can draw their neck in while folding it under their spine; and the Pleurodira, which have to fold their neck to the side.

Head

Most turtles and tortoises have eyes placed on the upper sides of their heads. Species of turtles that spend most of their life on land have their eyes looking down at objects in front of them. Some aquatic turtles, such as snapping turtles and soft-shelled turtles, have eyes closer to the top of the head. These species of turtles can hide from predators in shallow water where they lie entirely submerged except for their eyes and nostrils. Sea turtles possess glands near their eyes that produce salty tears that rids their body of excess salt taken in from the water they drink.

Turtles are thought to have exceptional night vision due to the unusually large amount of rod cells in their retinas. Normal daytime vision is marginal at best due to their color-blindness and poor visual acuity. In addition to daytime vision problems, turtles have very poor pursuit movement abilities, which is most likely due to the fact that pursuit movement abilities are normally reserved for predators that hunt quick moving prey.

Turtles have a rigid beak. Turtles use their jaws to cut and chew food. Instead of teeth, the upper and lower jaws of the turtle are covered by horny ridges. Their ancient ancestors have teeth unlike modern-day turtles. Carnivorous turtles usually have knife-sharp ridges for slicing through their prey. Herbivourous turtles have serrated edged ridges that help them cut through tough plants. Turtles use their tongues to swallow food, but they can't, unlike most reptiles, stick out their tongues to catch food.

Shell

The upper shell of the turtle is called the carapace. The lower shell that encases the belly is called the plastron. The carapace and plastron are joined together on the turtle's sides by bony structures called bridges. The inner layer of a turtle's shell is made up of about 60 bones that includes portions of the backbone and the ribs, meaning the turtle cannot crawl out of its shell. In most turtles, the outer layer of the shell is covered by horny scales called scutes that are part of its outer skin, or epidermis. Scutes are made up of a fibrous protein called keratin that also makes up the scales of other reptiles. These scutes overlap the seams between the shell bones and add strength to the shell. Some turtles do not have horny scutes. For example, the leatherback sea turtle and the soft-shelled turtles have shells covered with leathery skin instead.

The shape of the shell gives helpful clues to how the turtle lives. Most tortoises have a large dome-shaped shell that makes it difficult for predators to crush the shell between their jaws. One of the few

exceptions is the African pancake tortoise which has a flat, flexible shell that allows it to hide in rock crevices. Most aquatic turtles have flat, streamlined shells which aid in swimming and diving. American snapping turtles and musk turtles have small, cross-shaped plastrons that give them more efficient leg movement for walking along the bottom of ponds and streams.

Tortoises have rather heavy shells in contrast to aquatic and soft-shelled turtles which have lighter shells that help them avoid sinking in water and swim faster and more agilely. These lighter shells have large spaces called fontanelles between the shell bones. The shell of a leatherback turtle is extremely light because they lack scutes and contain many fontanelles.

The color of a turtle's shell may vary. Shells are commonly coloured brown, black, or olive green. In some species, shells may have red, orange, yellow, or grey markings and these markings are often spots, lines, or irregular blotches. One of the most colorful turtles is the eastern painted turtle which includes a yellow plastron and a black or olive shell with red markings around the rim.

Skin and Moulting

As mentioned above, the outer layer of the shell is part of the skin, each scute (or plate) on the shell corresponding to a single modified scale. The remainder of the skin is composed of skin with much smaller scales, similar to the skin of other reptiles. Turtles and terrapins do not moult their skins all in one go, as snakes do, but continuously, in small pieces. When kept in aquaria, small sheets of dead skin can be seen in the water (often appearing to be a thin piece of plastic) when it has been sloughed off, often when the animal deliberately rubs itself against a piece of wood or stone. Tortoises also shed skin, but a lot of dead skin is allowed to accumulate into thick knobs and plates that provide protection to parts of the body outside the shell.

The scutes on the shell are never moulted, and, as they accumulate over time, the shell becomes thicker. By counting the rings formed by the stack of smaller, older scutes on top of the larger, newer ones, it is possible to estimate the age of a turtle, if you know how many scutes are produced in a year [3]. This method is not very accurate, partly because growth rate is not constant, but also because some of the scutes eventually fall away from the shell.

Limbs

Terrestrial tortoises have short, sturdy feet. Tortoises are famous for moving slowly, in part because of their heavy shell but also because of the relatively inefficient sprawling gait that they have, with the legs being bent, as with lizards rather than being straight and directly under the body, as is the case with mammals.

The amphibious turtles normally have limbs similar to those of tortoises except that the feet are webbed and often have long claws. These turtles swim using all four feet in a way similar to the dog paddle, with the feet on the left and right side of the body alternately providing thrust. Large turtles tend to swim less than smaller ones, and the very big species, such as aligator snapping turtles, hardly swim at all, preferring to simply walk along the bottom of the river or lake. As well as webbed feet, turtles also have very long claws, used to help them clamber onto riverbanks and floating logs, upon which they like to bask. Male turtles tend to have particularly long claws, and these appear to be used to stimulate the female while mating. While most turtles have webbed feet, a few turtles, such as the pig-nose turtles, have true flippers, with the digits being fused into paddles and the claws being relatively small. These species swim in the same way as sea turtles (see below)

Sea turtles are almost entirely aquatic and instead of feet they have flippers. Sea turtles "fly" through the water, using the an up-and-down motion of the front flippers to generate thrust; the back feet are not used for propulsion but may be used as rudders for steering. Compared with freshwater turtles, sea turtles have very limited mobility on land, and apart from the dash from the nest to the sea as hatchlings, male sea turtles normally never leave the sea. Females must come back onto land to lay eggs. They move very slowly and laboriously, dragging themselves forwards with their flippers. The back flippers are used to dig the burrow and then fill it back with sand once the eggs have been deposited.

Order Testudines - turtles, tortoises, and terrapins

Suborder Paracryptodira (extinct)

Suborder Cryptodira

- Familia Chelydridae (Snapping Turtles)
  Family Meiolaniidae (Horned turtle, extinct)
- **Superfamily Testudinoidae**
  - Family Haichemydidae (extinct)
    Family Sinochelyidae (extinct)
    Family Lindholmemydidae (extinct)
    Family Testudinidae (Tortoises)
    Family Geoemydidae (Asian River Turtles, Leaf and Roofed Turtles, Asian Box Turtles)
    Family Emydidae (Pond Turtles/Box and Water Turtles)
- **Superfamily Trionychoidae**
  - Family Adocidae (extinct)
    Family Carettochelyidae (Pignose Turtles)
    Family Trionychidae (SoftshellTurtles)
- **Superfamily Kinosternoidae**
  - Family Dermatemydidae (River Turtles)
    Family Kinosternidae (Mud and Musk Turtles)
    Family Platysternidae (Big-headed Turtles)
- **Superfamily Chelonioidae** (Sea Turtles)
  - Family Toxochelyidae (extinct)
    Family Cheloniidae (Green Sea Turtles and relatives)
    Family Thalassemyidae (extinct)
    Family Dermochelyidae (Leatherback Turtles)
    Family Protostegidae (extinct)

Suborder Pleurodira

- Family Proterochersidae (extinct)
  Family Chelidae (Austro-American Sideneck Turtles)
  Family Araripemydidae (extinct)
- **Superfamily Pelomedusoidae**
  - Family Pelomedusidae (Afro-American Sideneck Turtles)

Family Bothremydidae (extinct)

Family Podocnemididae (Madagascan Big-headed and American Sideneck River Turtles)

See also

- Turtles and tortoises in popular culture

Further reading

- Iskandar, DT (2000). *Turtles and Crocodiles of Insular Southeast Asia and New Guinea*. ITB, Bandung.

List of Testudines families | Chelodina | Fictional turtles | Kinosternidae | Sea turtles | Tortoises | Cheloniinae | African helmeted turtle

List of Testudines families

Turtles
Fossil range: Triassic - Recent
Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Testudines, Linnaeus, 1758

Testudines are an order of reptile commonly known as turtles, tortoises and terrapins. The testudines are some of the most ancient reptiles alive, with only the tuataras considered more primitive. There are approximately 300 extant species of testudines, split into two suborders: the Cryptodirans and the Pleurodirans. The distinction between these two suborders is based on the mode in which they cover their head and neck. The Pleurodirans, also called the side-necked turtles, have long necks, and fold them sideways to align them with the shell. The Cryptodirans pull their neck straight back to conceal their head within the shell.

Cryptodira - 11 families, 74 genera, over 200 species

Family	Genera	Common Names	Example Species
Carettochelyidae Boulenger, 1887	1	Australiasian Pig-nose Turtle	Australasian Pig-Nose Turtle (*Carettochelys insculpta*)
Cheloniidae Oppel, 1811	5	Sea turtles	Green Sea Turtle (*Chelonia mydas*)
Chelydridae Gray, 1831	2	Snapping turtles	Alligator Snapping Turtle (*Macrochelys temminckii*)
Dermatemydidae Gray, 1870	1	Mesoamerican River Turtle	Mesoamerican River Turtle (*Dermatemys mawii*)

Dermochelyidae Fitzinger, 184	1	Leatherback Sea Turtle	Leatherback Sea Turtle (*Dermochelys coriacea*)
Emydidae Rafinesque, 1815	10	Box or water turtles	Red-eared Slider (*Trachemys scripta elegans*)
Geoemydidae Theobald, 1868	24	Asian river, leaf, roofed or Asian box turtles	Eastern Box Turtle (*Terrapene carolina carolina*)
Kinosternidae Agassiz, 1857	4	Mud or musk turtles	Common Musk Turtle (*Sternotherus odoratus*)
Platysternidae Gray, 1869	1	Big-headed turtles	Big-headed Turtle (*Platysternon megacephalum*)
Testudinidae Batsch, 1788	11	Tortoises	Aldabra Giant Tortoise (*Geochelone gigantea*)
Trionychidae Fitzinger, 1826	14	Softshell turtles	Spiny Softshell Turtle (*Apalone spinifera*)

Pleurodira - 3 families, 16 genera, over 60 species

Family	Genera	Common Names	Example Species
Chelidae Gray, 1831	11	Austro-American Sideneck Turtles	Common Snakeneck Turtle (*Chelodina longicollis*)
Pelomedusidae Cope, 1868	2	Afro-American	African helmeted

		Sideneck Turtles	turtle (*Pelomedusa subrufa*)
Podocnemididae Gray, 1869	3	Madagascan big-headed and American sideneck river turtles	Madagascan Big-headed Turtle (*Erymnochelys madagascariensis*)

References

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- David T. Kirkpatrick (November/December 1995). Platysternon megacephalum pp. 40 - 47.. Reptile & Amphibian Magazine. Retrieved on 2006-07-27.
- *Cogger, H.G., R.G. Zweifel, and D. Kirschner (2004). Encyclopedia of Reptiles & Amphibians Second Edition. Fog City Press. ISBN 1-877019-69-0.*

Chelodina

Conservation status: Secure

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Testudines
Suborder: Pleurodira
Family: Chelidae
Genus: ***Chelodina,*** Fitzinger, 1826
Species: *See text*

Chelodina is an ancient genus of Chelid turtles native to Australia, New Guinea and the island of Roti of the Indonesian archepeligo. The first fossils (C. alanrixi) are known from Queensland from the Eocene period. The turtles within this genus are small to medium sized, with oval shaped carapace. They are side-necked turtles, meaning they tuck their head partially around the side of their body when threatened instead of directly backwards. Chelodina and the genus Macrochelodina describe snake-necked turtles.

Taxonomy

- *Chelodina alanrixi* (fossil)
- *Chelodina insculpta* (fossil)
- *Chelodina burrungandjii* (Thomson, Kennett & Georges, 2000)
- *Chelodina canni* (McCord & Thompson, 2002)
- *Chelodina expansa* (Gray, 1857)
- *Chelodina kuchlingi* (Cann, 1997)
- *Chelodina longicollis* (Shaw, 1794)
- *Chelodina mccordi* (Rhodin, 1994)
- *Chelodina novaeguineae* (Boulenger, 1888)
- *Chelodina oblonga* (Gray, 1841)
- *Chelodina parkeri* (Rhodin and Mittermeier, 1976)
- *Chelodina reimanni* (Philippen and Grossmann, 1990)
- *Chelodina rugosa* (Ogilby, 1890)
- *Chelodina siebenrocki* (Werner, 1901)
- *Chelodina steindachneri* (Siebenrock, 1914)Kinosternidae

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Testudines
Suborder: Cryptodira
Superfamily: Kinosternoidea
Family: **Kinosternidae,** Agassiz, 1857
Genera
Kinosternon
Sternotherus
Claudius (genus)
Staurotypus

Kinosternidae is a family of mostly small turtles that includes the mud and musk turtles. The family Kinosternidae contains 25 species within 4 genera, but taxonomic reclassification is an ongoing process so many sources vary on the exact numbers of species and subspecies. They inhabit slow-moving bodies of water, often with soft, muddy bottoms and abundant vegetation.

Contents

Description

Most kinosternids are small turtles, between 4 and 6 inches with a heavily domed shell that has a distinct keel down its center. The genus Staurotypus gets much larger, to 12 inches. Females are generally larger than males, but males have a much longer tail. They can be black, brown, green, or yellowish in color. Most species do not have shell markings, but some species have radiating black markings on each carapace scute. Some species have distinctive yellow striping along the sides of their head and neck.

The musk turtles are so named because they are capable of releasing a foul smelling musk from glands under the rear of their shell when disturbed. They are native to North and South America.

Diet

All members of the family are carnivores, feeding on crustaceans, aquatic insects, mollusks, annelids, amphibians, small fish, and sometimes carrion.

Reproduction

Kinosternids lay approximately four hard-shelled eggs during the late spring and early summer. After hatching, some species overwinter in the subterranean nest, emerging the following spring. Some adults also spend the winter on land, constructing a burrow with a small air hole that is used on warm days.

Kinosternids contain the only species of turtle known, or at least suspected, to exhibit parental care. Studies of the yellow mud turtle in Nebraska, USA, suggest females sometimes stay with the nest and may urinate on the eggs long after laying, to either keep them moist or to protect them from snake predation (by making them less palatable).

Taxonomy

Family Kinosternidae
Subfamily Kinosterninae

- Genus *Kinosternon*
  - Tabasco Mud Turtle, Kinosternon acutum (Gray, 1831)
    Alamos Mud Turtle, Kinosternon alamosae (Berry & Legler, 1980)
    Central American Mud Turtle, Kinosternon angustipons (Legler, 1965)
    Striped Mud Turtle, Kinosternon baurii (Garman, 1891)
    Jalisco Mud Turtle, Kinosternon chimalhuaca (Berry, Seidel, & Iverson, 1997)
    Creaser's Mud Turtle, Kinosternon creaseri (Hartweg, 1934)
    Red-cheeked Mud Turtle, Kinosternon cruentatum (Duméril, Bibron & Duméril, 1851)

- Colombian Mud Turtle, Kinosternon dunni (Schmidt, 1947)
  Yellow Mud Turtle, Kinosternon flavescens (Agassiz, 1857)
  Herrara's Mud Turtle , Kinosternon herrerai (Stejneger, 1945)
  Mexican Mud Turtle, Kinosternon hirtipes (Wagler, 1830)
  Mexican Mud Turtle, Kinosternon integrum (Le Conte, 1854)
  White-lipped Mud Turtle, Kinosternon leucostomum (Duméril, Bibron & Duméril, 1851)
  Oaxaca Mud Turtle, Kinosternon oaxacae (Berry & Iverson, 1980)

-
  - Scorpion Mud Turtle, Kinosternon scorpioides (Linnaeus, 1766)
    Sonoran Mud Turtle, Kinosternon sonoriense (Le Conte, 1854)
    Kinosternon spurrelli (Boulenger, 1913)
    Eastern Mud Turtle, Kinosternon subrubrum (Lacépède, 1788)
- Genus *Sternotherus*
  - Razorback Musk Turtle, Sternotherus carinatus (Gray, 1855)
    Flattened Musk Turtle, Sternotherus depressus (Tinkle & Webb, 1955)
    Loggerhead Musk Turtle, Sternotherus minor (Agassiz, 1857)
    Common Musk Turtle or Stinkpot, Sternotherus odoratus

(Sonnini & Latreille, 1802)

Subfamily Staurotypinae

- Genus *Claudius*
  - Narrow-bridged Musk Turtle, Claudius angustatus (Cope, 1865)
- Genus *Staurotypus*
  - Chiapus Giant Musk Turtle, Staurotypus salvinii (Gray, 1864)
    Mexican Giant Musk Turtle, Staurotypus triporcatus (Wiegmann, 1828)

Tortoises

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Testudines
Suborder: Cryptodira
Superfamily: Testudinoidea
Family: **Testudinidae**
Genera
Chersina
Dipsochelys
Furculachelys
Geochelone
Gopherus
Homopus
Indotestudo
Kinixys
Malacochersus
Manouria
Psammobates
Pyxis
Testudo

A **tortoise** is a land-dwelling reptile of the order Testudines.

Contents

Description

Like its aquatic cousins, the turtle and the terrapin, the tortoise is shielded from predators by a shell. The top part of the shell is the carapace, the underside is the plastron, and the two are connected by the bridge. The tortoise has both an endoskeleton and an exoskeleton. Tortoises can vary in size from a few centimetres to two meters. Most land tortoises are herbivorous in the wild. The carapace can help indicate the age of the tortoise by the number of concentric rings, much like the cross-section of a tree. Males tend to have a longer, protruding neck plate than their female counterparts.

Tortoises tend to be diurnal animals with tendencies to be crepuscular depending on the ambient temperatures. They are generally reclusive and shy.

Most land based tortoises are herbivores, feeding on grazing grasses, weeds, leafy greens, flowers, and certain fruits. Their main diet consists of alfalfa, clover, dandelions, and leafy weeds.

Female tortoises dig and lay about a dozen eggs in burrows or holes they dig. Hatchlings take approximately 90-120 days to incubate from ping-pong-ball sized eggs. The hatchlings break out of their shells with a front beak. Most hatchlings are born with an embryonic egg sac, serving as a source of food for the first couple of days. They are capable of eating solid food in about 3-7 days.

The giant tortoises of the Galápagos Islands helped Charles Darwin formulate his theory of evolution, since the isolated populations on the different islands, although descended from a common ancestor, had diverged to different forms.

The first turtles already existed in the era of the dinosaurs, some 300 million years ago. Turtles and tortoises are the only surviving branch of the even more ancient clade Anapsida, which includes groups such as the procolophonoids, millerettids and pareiasaurs. Most of the anapsids became extinct in the late Permian period, with the exception of the procolophonoids and the precursors of the testudines (turtles and tortoises).

While the Oxford English Dictionary refers to a tortoise as a "slow-moving land reptile with a scaly or leathery domed shell into which it can retract its head and legs" [1], in American English it is not uncommon for such animals to be referred to as turtle.

Lifespan

Tortoises generally have lifespans comparable with those of human beings, and some individuals are known to have lived longer than 150 years. Because of this, they symbolize longevity in some cultures, such as China. The oldest tortoise ever recorded, indeed the oldest individual animal ever recorded, was Tui Malila, who was presented to the Tongan royal family by the British explorer Captain Cook shortly after its birth in 1777. Tui Malila remained in the care of the Tongan royal family until its death by natural causes on May 19, 1965. This means that upon its death, Tui Malila was 188 years old [2], a figure that gives it the title of oldest Cheloniinae (tortoise or turtle) ever recorded.

The Alipore zoo in India was the home to Adwaitya, which zoo officials claimed was the oldest living creature until its death on Thursday, March 23, 2006. Adwaitya (sometimes spelled with two d's) was an Aldabra Giant Tortoise brought to India by Lord Wellesley who handed it over to the Alipur Zoological Gardens in 1875 when the zoo was set up. Zoo officials state they have documentation showing that Adwaitya was at least 130 years old, but claim that he was over 250 years old (although this has not been scientifically verified). Adwaitya was said to be the pet of Robert Clive 1.

Harriet, a resident at the Australia Zoo in Queensland, was apocryphally thought to have been brought to England by Charles Darwin aboard the Beagle. Harriet died on June 23, 2006, just shy of her 176th birthday.

Partial species list

- **Chersina**
  - *Chersina angulata*, Bowsprit Tortoise
- **Dipsochelys**
  - Dipsochelys abrupta, Conservation status: Extinct
    Dipsochelys arnoldi, Arnold's Giant Tortoise, Conservation status: Extinct in the wild

    Dipsochelys daudinii, Conservation status: Extinct
    Dipsochelys dussumieri, Aldabra Giant Tortoise, Conservation status: Vulnerable
    Dipsochelys grandidieri, Conservation status: Extinct
    Dipsochelys hololissa, Seychelles giant tortoise, Conservation status: Extinct in the wild

- **Furculachelys**
  - *Furculachelys nabeulensis*, Tunisian Spur-thigh Tortoise
- **Geochelone**
  - Geochelone carbonaria, Red-Footed Tortoise
    Geochelone chilensis, Chaco Tortoise, Conservation status: Vulnerable
    Geochelone denticulata, Yellow-Footed Tortoise, Conservation status: Vulnerable
    Geochelone elegans, Indian Star Tortoise
    Geochelone nigra, Galápagos Giant Tortoise, Conservation status: Vulnerable
    Geochelone pardalis, Leopard Tortoise
    Geochelone platynota, Burmese Star Tortoise, Conservation status: Critical
    Geochelone radiata, Radiated Tortoise, Conservation status: Vulnerable
    Geochelone sulcata, African Spurred Tortoise (Sulcata Tortoise)
    Geochelone yniphora, Angulated Tortoise, Conservation status: Endangered
- **Gopherus**
  - Gopherus agassizii, Desert Tortoise, Conservation status: Vulnerable
    Gopherus berlandieri, Texas Tortoise
    Gopherus flavomarginatus, Bolson Tortoise, Conservation status: Vulnerable
    Gopherus polyphemus, Gopher Tortoise, Conservation status: Vulnerable

- **Homopus**
    - Homopus aerolatus, Parrot-Beaked Cape Tortoise
      Homopus boulengeri, Boulenger's Cape Tortoise
      Homopus femoralis, Karroo Cape Tortoise
      Homopus signatus, Speckled Cape Tortoise, Conservation status: Lower risk
      Homopus bergeri, Berger's Cape Tortoise, Conservation status: Vulnerable
- **Indotestudo**
    - Indotestudo elongata, Elongated Tortoise, Conservation status: Endangered
      Indotestudo forsteni, Travancore Tortoise, Conservation status: Endangered
- **Kinixys**
    - Kinixys belliana, Bell's Hinge-Backed Tortoise
      Kinixys erosa, Serrated Hinge-Backed Tortoise, Conservation status: Data deficient
      Kinixys homeana, Home's Hinge-Backed Tortoise, Conservation status: Data deficient
      Kinixys natalensis, Natal Hinge-Backed Tortoise, Conservation status: Lower risk
      Kinixys spekii
- **Malacochersus**
    - Malacochersus tornieri, Pancake Tortoise, Conservation status: Vulnerable
- **Manouria**
    - Manouria emys, Brown Tortoise (Mountain Tortoise), Conservation status: Endangered
      Manouria impressa, Impressed Tortoise, Conservation status: Vulnerable
- **Psammobates**
    - Psammobates geometricus, Geometric Tortoise, Conservation status: Endangered
      Psammobates oculiferus, Serrated Star Tortoise
      Psammobates tentorius, African Tent Tortoise
- **Pyxis**
    - Pyxis arachnoides, Madagascan Spider Tortoise, Conservation status: Vulnerable
      Pyxis planicauda, Madagascan Flat-Tailed Tortoise, Conservation status: Endangered
- **Testudo**
    - Testudo graeca, Greek Tortoise (Spur-Thighed Tortoise), Conservation status: Vulnerable
      Testudo hermanni, Herman's Tortoise,

Conservation status: Lower risk

Testudo horsfieldii, Russian Tortoise (Horsfield's Tortoise, or Central Asian Tortoise)

Testudo kleinmanni, Egyptian Tortoise, Conservation status: Critical

Testudo werneri, Negev Tortoise, Conservation status: Critical

Testudo marginata, Marginated Tortoise

Testudo tabulata, Jabuti

Further reading

- Chambers, Paul. *A Sheltered Life: The Unexpected History of the Giant Tortoise*. John Murray (Publishers), London. 2004. ISBN 0-7195-6528-6.
- Gerlach, Justin. Giant Tortoises of the Indian Ocean. Chimiara publishers, Frankfurt. 2004

See also

- Turtles and tortoises in popular culture

Marginated Tortoise | Fictional tortoises

Marginated Tortoise

Conservation status: Least concern (LR/lc)

Kingdom: Animalia
Phylum: Chordata
Class: Sauropsida
Order: Testudines
Suborder: Cryptodira
Family: Testudinidae
Genus: *Testudo*
Species: ***T. marginata***
Binomial name: ***Testudo marginata***, Schoepf, 1789

The **Marginated Tortoise** (*Testudo marginata*) is the largest European tortoise, reaching a weight of up to 5 kg (11 pounds) and a length of 35 cm (14 inches). Its shell is oblong and has a notable thickness around the middle of the body. The posterior end of the shell has a saw-like formation, flanged outward like a bell. The carapace of adult specimens is almost completely black, with yellow highlights. The ventral shell is lighter coloured and has pairs of triangular markings with the points facing the rear of the animal. The front sides of the limbs are covered with large scales. In old female specimens, the rear flaps of the underside of the plastron are somewhat moveable. The tail is notable for a lengthwise marking and for an undivided carapace over the tail. Males have a longer tail, which is thicker at the base than the females. Their underside is more strongly indented. Males are also often larger than the females. The females lay their hard-shelled spherical eggs in the soil in May and June.

Contents

Habitat and feeding habits

The natural range of the Marginated Tortoise is southern Greece, from the Peloponnesus to Mount Olympus. They are also found in isolated zones of the Balkans and Italy, with a somewhat broader range in northeastern Sardinia.

The Marginated Tortoise lives in more mountainous regions than Herman's Tortoise (Testudo hermanni). It can be found in elevations as high as 1,600 m (5,250 feet). The black color of the carapace is helpful for survival in this environment, as it allows the tortoise to absorb a great deal of heat in a short time, helping it maintain its body temperature. Similarly, the lighter colored underside slows the radiation of body heat into the cold ground. Early in the morning, Marginated Tortoises bask in the sun to raise their body temperature, and then search for food. After feeding, the tortoises return to their shelters in the hot midday hours, leaving them again in the late afternoon.

Marginated Tortoises' food source consists primarily of plants from their native Mediterranean region. In captivity, the primary foodstuffs are dandelions, clover, salad leaves such as rocket or watercress, and also leaves from bean, radish, and crowfoot plants. Sometimes even grass and hay will be eaten, along with fruits. Lettuce will be eagerly devoured, but owing to its low nutrient value should not generally be given. They are primarily herbivorous, but they need a small amount of animal protein in their diet, particularly in the case of babies and egg-laying mothers. This protein is generally provided by earthworms and snails.

Subspecies and related species

The primary subspecies of *Testudo marginata* is Testudo marginata marginata (Schoepf, 1789), described above. Two additional varieties are generally mentioned in connection with the marginated tortoise. Testudo marginata sarda (Mayer, 1992) is a separate population in Sardinia. This subspecies has less strongly bent tiles in the posterior of the carapace, and the posterior of the carapace is almost smooth compared with the saw-like *Testudo marginata marginata*.

A particularly small variation of the marginated tortoise was discovered in the southwestern part of the Pelopponesus. However, the Dwarf Marginated Tortoise is not a subspecies, but rather a related species in the same genus (*Testudo weissingeri*, Bour, 1996).

Testudo marginata is also closely related to the Greek Tortoise or Spur-thighed Tortoise (Testudo graeca). Both have very similar bodily characteristics, for example, an oblong carapace, large scales on the front legs, large covering for the head and cone-like scales on the upper thigh, undivided tail covering, moveable stomach plates, and lack of a tail spike. Presumably, Testudo marginata evolved from Testudo graeca as a population more suited for life in the mountainous regions. Evidence in favor of this is the wide geographical region and the extremely large number of subspecies of Testudo graeca, including a subspecies in Turkey with strongly bent carapace tiles, like the Marginated Tortoise. Testudo marginata on the other hand, despite the two subspecies, presents a much more unified appearance, which points toward an earlier appearance in evolutionary history. In captivity, the two species often cross-breed.

Mating and reproduction

Immediately after waking from hibernation the mating instinct starts up. The males follow the females with great interest, encircling them, biting them on the limbs, ramming them, and trying to mount them. During copulation, the male opens his mouth, showing his red tongue and making loud cries. The tone of the copulation cry is almost sobbing with long, deep tones, in contrast to *Testudo hermanni*, in which there is a much higher-toned peeping noise.

During mating, the female stands still and holds her head to the side, looking up to see the opened mouth of the male. It appears that the red tongue serves a signalling function. The female moves her head from left to right in the same rhythm as the male's cries.

Afterwards the female seeks out an adequate location to lay her eggs. Once such a place is found, the female stands still, propping both front legs firmly against the ground. Then she digs out a hole with her hind legs, alternating between left and right, beginning with simply scratching the ground but eventually moving large quantities of soil which are piled up beside the hole. The depth of the hole is determined by the length of her hind legs. If the ground is too hard to dig, the female releases water from her anal gland to soften it.

Once the hole is dug egg laying begins. Each egg is gently rolled back into the hole. After the last egg the female immediately begins refilling the hole, again using her hind legs. Finally, she stamps the opening closed with her feet so that the ground regains its natural hardness. Larger animals may lay eggs as many as three times per summer, with about 15 eggs per clutch.

Incubation and hatching

The incubation period averages about 100 days under natural conditions, which is relatively short among tortoises. Many tropical tortoises have incubation periods of up to 200 days. The relatively short time is an adaptation to the subtropical Mediterranean climate, where the summers are not as long. In an incubator, this time is notably shorter: with an incubation temperature of 31.5 °C (89 °F) the eggs will begin hatching after 60 days.

Unlike bird eggs, the yolk and albumen of reptile eggs are not separated by a membrane. After a few days, the heavy yolk components sink to the bottom of the egg. On top of this floats the embryonal disk, surrounded by albumen. For this reason the tortoise eggs cannot be turned after the yolk settles without damaging or killing the embryo.

It is possible to see with the naked eye if the eggs are developing healthily. Freshly laid eggs have a gray-white color. Shortly thereafter, a bright white spot forms on the uppermost point of the egg. This spot gradually grows until the entire egg is bright white.

After the embryo has developed fully in the egg, the young animal breaks the shell with its egg tooth from inside, creates a small opening, and for the first time fill its lungs with air. Afterwards, it pulls back into the egg and works on the shell with its beak until it opens completely. In nature, the animal remains below ground for the first two weeks. Here it is safe from predators yet is still able to grow, as it is nourished by the yolk sac. The young animals lead cautious and secretive lives, normally remaining in the shade. They avoid full sunlight because of the great danger of overheating.

Marginated Tortoises grow very rapidly. In an ideal biotope, or with good handling, they gain 100–500 g (4–17 oz) yearly. This quick rate of growth lasts throughout their youth. After the twentieth year of life, further growth is minimal. They may live to between 100 and 140 years, according to the best estimates of scientists.

In captivity

In a terrarium

Tortoises can thrive in captivity if the owner understands their needs well. A heat lamp is attached to the tortoise's table, directed in such a way that the 60-watt reflector bulb is some 15–20 cm (6–8 in) from the floor of the table, which is covered with about 5 cm of substraite, loam based soil and play sand. When the lamp is turned on in the morning, the animals emerge from the ground, bask in the light to warm themselves, and begin to eat. They should be fed several times a day with clover, dandelions and garden weeds (check first as a few are harmful. Some owners give pellet food occasionally, these should be avoided, only feed your tortoise what they would naturally eat in the wild, their digestive systems do not cope well with protein, of which there is a lot in pellet foods. The animals also require ultraviolet light, thus they should be allowed to bask in the sunlight daily, but for only a short period of time. In the summer, they can be taken outdoors for this purpose, in the winter if not hybernated they need access to UVB light every day. Care must be taken to avoid allowing the tortoise to overheat (use a digital thermometer to keep a check).

Outdoors

In temperate zones, Marginated Tortoises can be kept outside from approximately mid-March to October. Their pen should be in the sunniest place in the garden, preferably close to the house. It is important to provide a wooden house where they can get into the shade. They should be provided enough gravel that they can completely bury themselves when needed.

The animals will leave the house in the morning, warm themselves, and eat. Afterwards, they return to the house. In the late afternoon, they will reemerge from their shelter. Tortoises do not need as much sunlight as many assume is required for a reptile. By October, they will take longer and longer pauses during the day. At this point, they should be transferred into a roomy crate filled with dry leaves and kept in a cool room. With a temperature under 10 °C (50 °F), they will hibernate until mid-March, though younger animals will awaken

much earlier.

References and further reading

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Cheloniinae

Turtles

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Subclass: Anapsida
Order: Testudines
Suborder: Cryptodira
Superfamily: Chelonioidea
Family: **Cheloniidae**
Genera
Chelonia
Eretmochelys
Natator

Cheloniinae is the subfamily of the family Cheloniidae. Its parent superfamily is Chelonioidea.

- Class: Reptilia
- Order: Testudines
- SubOrder: Cryptodira
- SuperFamily: Chelonioidea
- Family: Cheloniidae
- SubFamily: Cheloniinae

The members of the family, and genera that make it up, are:

- Genus *Chelonia*
  - *Chelonia mydas* (Green Sea Turtle)
- Genus *Eretmochelys*
  - *Eretmochelys imbricata* (Hawksbill Sea Turtle)
- Genus *Natator*
  - *Natator depressa* (Flat Back Turtle) (Previously in *Chelonia*)

See also

- Turtle
- Sea turtle
- Reptiles

African helmeted turtle

Conservation status: Secure

Kingdom: Animalia
Phylum: Chordata
Class: Reptilia
Order: Testudines
Suborder: Pleurodira
Family: Pelomedusidae
Genus: *Pelomedusa*
Species: ***P. subrufa***
Binomial name: ***Pelomedusa subrufa***

The **African helmeted turtle**, also known as the **Marsh Terrapin**, is a small turtle (6 to 7 inches as an adult) withan olive-green or brown carapace (shell). The tops of the tail and limbs are a grayish brown, while the underside is yellowish. The male turtle is distinguished by its long, thick tail. Females tend to have a shorter tail and a broader carapace. Hatchlings have a shell size of about 1 and 1/4 inches in length, and are olive to black in color. It also has two small tubercles under the chin and musk glands in the sides of the carapace. The African helmeted turtles lacks a hinge at the front of its plastron, and so cannot cover its head with it like other turtles.

The African helmeted turtle is omnivorous and will eat almost anything. Some of the main items in its diet are insects, small crustaceans, fish, earthworms, and snails. They may also feed on carion. The fine claws on its feet help it tear its prey apart. Groups of these turtles have been observed capturing and drowning doves when they come to drink.

The range of *Pelomedusa subrufa* spreads over a large portion of central and southern Africa. It can be found as far west as Ghana and as far south as the Cape of Africa. It has also been found in Madagascar and Yemen. They are semi-aquatic animals, living in rivers, lakes, and marshes, and rain pools.

In spring, during courtship, the male will follow the female and extend his head touching her hindquarters and vent. If she is non-responsive he will nip and snap at her legs and tail. After mounting her carapace, he extends his head over hers swaying it in front of her face while expelling water from his nose.

The female will lay 13 to 16 eggs on average, normally during late spring and early summer. The eggs are covered with slime when laid, and placed in a flask shaped nest that is about 4 to 7 inches deep. The eggs hatch in 75- 90 days.

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